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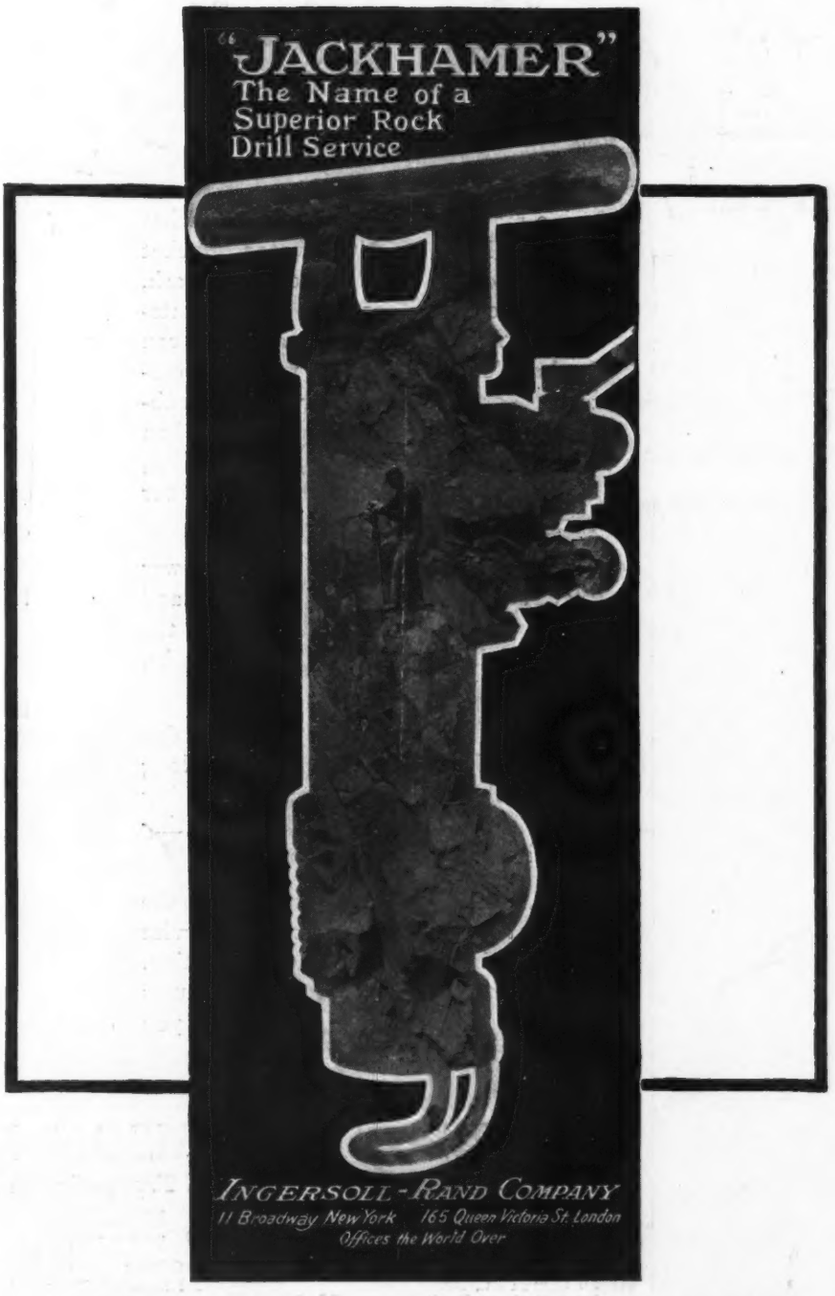

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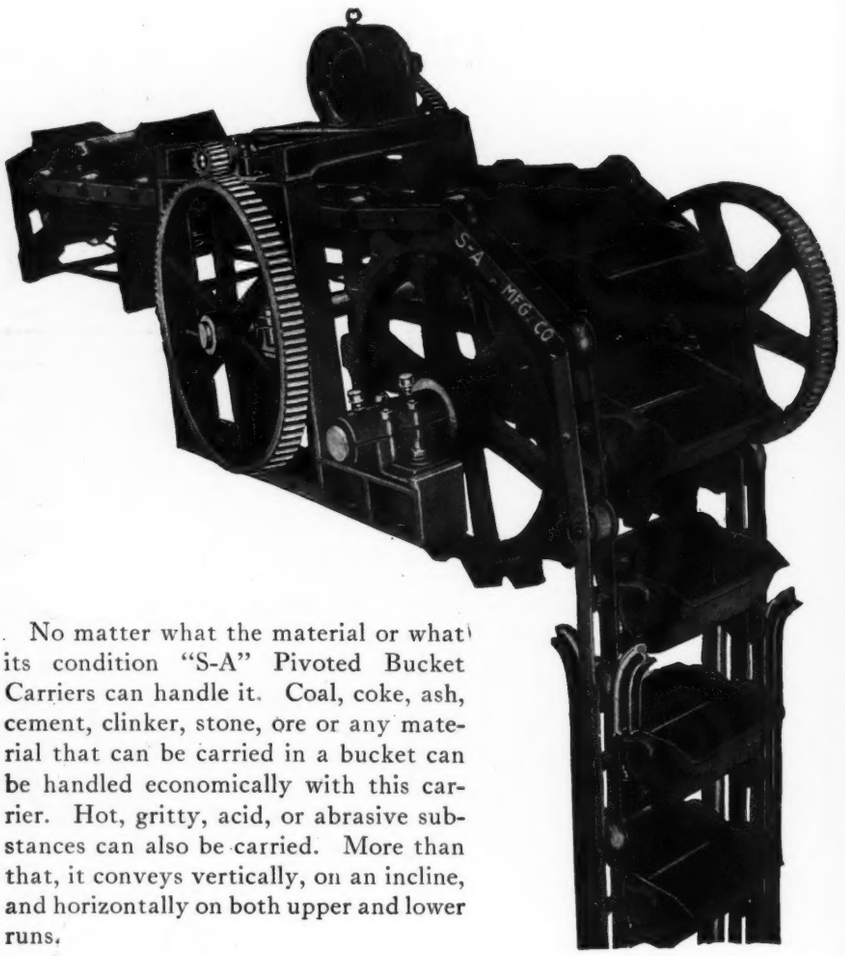

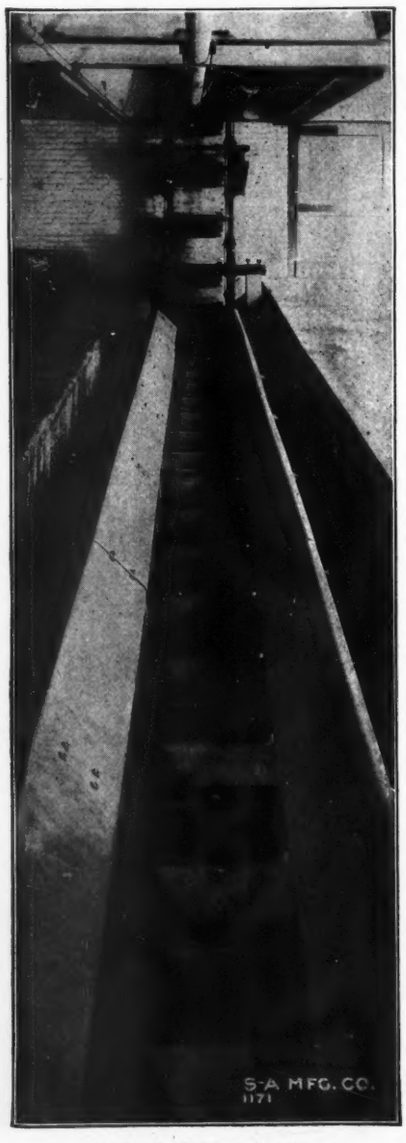

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HAND JIGGING AT CATAVI, BOLIVIA

Wolfram Mining in Bolivia*

BY G. F. J. PREUMONT

AS A TIN-PRODUCING country Bolivia is second in importance to the Malay States, but it is only within recent years that wolfram mining has reached any magnitude. In view of the development of the industry, a few notes may be of interest, especially as it is under no form of control. It is not much more than ten years ago that wolfram first made its appearance in the customs list of Bolivia as an export. Through the courtesy of the Bolivian customs officials the following table has been compiled, showing the production of *barilla*, or concentrates, averaging probably not less than 60% wolfram:

PRODUCTION OF WOLFRAM IN BOLIVIA

Year	Tons (2240 lb.)	Value
1908	186	£6,255
1909	150	5,902
1910	207	8,556
1911	292	13,967
1912	468	31,398
1913	278	25,098
1914	272	26,768
1915	779	93,615
1916	2,986	425,677
1917	3,828	535,201

The exports of wolfram in 1916, given by the customs authorities, were distributed among six countries, as is shown by the table in the next column.

*Abstracted from *Bull.* 173, I. M. M.

EXPORTS OF WOLFRAM FROM BOLIVIA IN 1916

Exported to	Tons	Value
United States	2,062.6	£294,046.5
Great Britain	873.0	124,448.5
France	25.5	3,643.0
Argentina	9.5	1,356.0
Peru	9.0	1,266.0
Chile	6.4	917.0
Totals	2,986.0	£425,677.0

The wolfram production in the various districts of Bolivia for 1916 was as follows:

WOLFRAM PRODUCTION IN BOLIVIA IN 1916

District	Tons	Value
La Paz	1,494.0	£212,983.5
Oruro	936.6	133,518.5
Potosi	332.6	47,414.0
Cochabamba	222.8	31,761.0
Totals	2,986.0	£425,677.0

From these figures it will be noted that La Paz is the first in importance, though some of the output credited to that district is probably produced in and exported through Oruro. The principal mines in La Paz are the fields of Palca or Yungas, Quime or Inquisivi, with others of less importance at Araca, and Colquiri. In the Oruro district are some important scheelite deposits at Conde Auque and elsewhere. In the Cochabamba district the principal mines are at Khami and Chicote, and the Uyuni district has produced, according to reports, moderate quantities of hüb-

nerite of remarkable purity at Salasala and in other localities. The wolfram industry in Bolivia differs from the tin industry in that the latter now depends on two mines alone for the production of nearly 40% of its output, whereas the former obtains its product from a great number of mines.

Wolfram is found mostly along the line of the Eastern Cordillera running from north to south, the occurrences extending far into Peru and the Argentine Republic at either end. This range of mountains consists chiefly of metamorphic schists and slates, strongly contorted and folded, probably Palæozoic, and described by d'Orbigny as Silurian. No fossils are found in these crystalline rocks, above which are series of unconformable quartzite, the whole being intruded at places by recent granite. Occasionally white mica is found in this rock.

Geology of the District

There are two outstanding massifs rising to great altitudes—Illimani, having a summit about 21,000 ft. high, and Mururata, slightly less, both, of course, covered with perpetual snow and practically inaccessible. Granite can be seen in the N.E. side of Illimani up to a height of about 13,000 ft., and rises possibly to a still greater altitude, and on Mururata granite is also prominent and forms the divide between La Paz and the Yungas Valley in places. In one or two regions detritic fragmental quartz overlies the granite or is in close proximity to it, and lower down schists and slates are encountered. The valleys are deep and for the most part have precipitous sides. Evidence of glacial action is less marked in this district than in the neighborhood of La Paz and down the watershed of the La Paz River.

The Cordillera Real, or main chain of mountains on which these deposits occur, is more imposing even than the eastern range described, but it is interrupted by a magnificent canyon between Taca and Saya, which forms a gorge at least 1000 yd. deep through which the Rio de la Paz flows. Granite appears more frequently on the Araca side *in situ;* glacial phenomena, such as moraines, are numerous and extensive, and many glaciers are still existent, and snowfields cover large tracts of country at heights of 16,000 ft. or more.

Occurrences of Wolfram Ore

Wolfram ore deposits and veins of quartz carrying wolframite occur in all constituent parts of the series mentioned, in granite, quartzite, or slate. In the Palca district, the San Francisco and Andina mines are both in granite; the vertical veins appear like gash veins and are much faulted, making mining difficult and slow. The wolframite occurs in bunches and spots, and is sorted easily by cobbing. The ground is extremely hard. The veins can be followed on the surface sometimes for as much as 200 yd., and have been mined from the surface in the most primitive manner. Both the mines mentioned are small producers, and others in the immediate neighborhood, such as Esmeralda, Dondavido, and El Inca, are even less important. Lower down, however, properties such as La Chojilla and Cerro Negro, which are in quartzite, are fair producers, but the most important properties are at Picho, with several veins in slate. This is at an altitude of about 10,000 ft. and is in a quasi-tropical climate. An abrupt contrast to this is afforded by the property called La Salvadora, which is situated at a height of more than 15,000 ft., in almost arctic surroundings, difficult of access and involving extremely arduous conditions of living.

Indians Are Wolfram Prospectors

An interesting property is La Nevada, situated on the eastern side of Mount Mururata and north of Illimani, on the trail to Lambate. Its altitude is about 14,750 ft., or slightly below the line of perpetual snow. The property was discovered by an Indian, who passed it on to some natives of Lambate, and it was subsequently purchased from them by its present owner, an American. Wolframite occurs here in quartz veins so nearly horizontal that they only dip 14° to the west, forming successive layers of quartz interstratified with quartzite, which are so near the surface that they can be mined economically as an open quarry and on a large scale. The occurrence is patchy, bunches of beautiful crystals often being found, but on the whole it is probably low grade. The property has the advantages of easy access, fairly endurable climatic conditions, available water power, and a good surrounding district from which to obtain supplies. It is at present on lease at a monthly rental to a buying agent for the French government, and produces about 250 quintals (10 tons) of 60% *barilla* concentrate per month. A drilling plant with compressors is in course of installation, and the only essentials required to make the venture successful are mining on a large scale and the maintenance of a good price for wolfram.

Some hope of obtaining alluvial wolframite thereabouts was at one time entertained, owing to the fact that the débris at the foot of the mine contained, in a number of places, considerable quantities of quartz spotted with metal. This expectation has not, however, been realized. Near by is the small equipment which forms all the ore-treatment plant for the mine, consisting of a couple of *quimbaletes* (rocking crushers made locally); two buddles and an ingenious hand-shaking table of small capacity. A roasting furnace to eliminate the pyritic contents of the *barilla* completes the outfit. The fuel employed is *taquia* (llama dung).

Tin Property Develops as Wolfram Producer

On the flank and southern side of the Illimani, a property (Cerro Negro) which was taken up a few years ago for the production of tin, has proved, instead, to be a producer of wolfram; it is, however, of small importance except in the sense that it draws attention to the possibilities in that district. The mine is at an altitude of about 14,000 ft., and is in quartzite which is considerably tilted, the veins being vertical and interbedded, but thin. Alluvial was expected below this deposit, but none was found of any appreciable value, owing, it was thought, to the presence of too much pyrites and some cassiterite. The property forms a connecting link with the fields toward Araca and thence to Quimsa-Cruz.

The *barilla* of wolfram produced in the district of Palca is of high grade, probably not below 66%, and very pure, and the associated minerals are mostly pyrites and pyrrhotite, with sometimes a little cassiterite. A little scheelite is also often found on the surface. The district is auriferous, and the old Spanish colonists appear to have had a fair number of gold mines in operation at one time. At present, the Olla de Oro mine is the only one producing that metal.

Strange to say, no wolfram has been found in its immediate vicinity. Most of the wolfram mines in Bolivia are situated at great altitudes, involving trying climatic conditions and extremely difficult means of access. Good roads are unknown, and transportation is solely by means of pack animals.

Araca District Has Many Small Producers

Araca is well known for its tin mines, which were for a long period held by German interests and are now controlled by a Chilean company. There are in that district perhaps a dozen small wolfram concerns run in primitive fashion, the production of which is not great. On the eastern fold of the Cordillera I noticed a peculiar instance of a vein of quartz carrying wolfram which outcropped into what must have been a glacial frontal moraine dating back to remote geologic times, as it was comparatively low ground. The lode is vertical and fairly rich, but it is almost unworkable, owing to the manner in which it had been crushed and broken by the action of the moraine, and so was a constant source of danger to the miners. The owner had made no effort to trace the vein at a lower level where it might be found in more solid condition, or, indeed, to follow it in any direction where it might have led out of the crushed zone. The production averages about one ton per month. The country toward Quime is so wild in character that little or no prospecting is done, and it remains for the native Indians to discover what they can, with the chance eventually of working the prospects on contract. Prospecting in these high altitudes is almost a physical impossibility to foreign-born miners.

Derelict Tin Companies Are Revived as Wolfram Producers

Quime itself is a small *pueblo* (village), around which are grouped many small wolfram and tin workings. In 1915, when the price of wolfram was at a high figure, it was the center of an extraordinary boom. The village is at a comparatively low altitude, and the mines are situated on the crests of the hills in the surrounding country. In the district of Quimsa-Cruz, behind Monte Blanco, which was formerly expected to prove an important tin district, half a dozen more or less derelict tin companies have taken a new lease of l[illegible]as wolfram concerns. One of these, the Pacuni mine, has already attained considerable importance and produces 10 to 15 tons of *barilla* per month. There are not more than two or three veins, which occur in granite fairly wide for that class of mining—from 2 to 3 ft. wide—and which can be traced on the surface for a distance of a few hundred yards. At the time of my visit, the company was engaged in installing equipment for crushing and concentration, and no doubt the output will be increased.

On the road to Caluyo are several small prospects, mostly in quartzite and on thin but frequently rich stringers. These mines are, relatively, insignificant, and one has to go on toward Oruro and Cochabamba to find mines of importance, such as the Taborga group, which is the most important producer in Bolivia, and Chicote, the property of Fricke, a German, who has been in the wolfram-mining business for many years.

A large proportion of the wolfram industry in Bolivia is now controlled by American interests, but the French have tried to take a share in the industry through their government. British interests are almost non-existent, except for the fact that some fairly large contracts for the purchase of ore to be delivered in England are in force. German activities are now probably disguised to a great extent under Chilean colors, and are at present more or less somnolent, whereas before the war they were paramount. The Taborga group, which is the largest producer of all, with an output of probably at least 1000 quintals (50 tons) per month, is in Bolivian hands.

Cost of Producing Wolfram in Bolivia

The cost of production is almost an unknown quantity to everyone, owners included. A common rule-of-thumb method of computing returns in Bolivia is to consider the monthly output in terms of the number of hands employed. Two quintals (a quintal represents 100 lb. of *barilla*) per man employed is considered to be a fair average production per month. This system of reckoning serves to give the value of individual concerns in a country where there is no publication of returns or profits. In this respect there is a general air of secretiveness, which is, however, probably practiced to a greater extent by the foreign interests than by those under native control; in the latter case the lack of information is doubtless due to ignorance rather than to any desire to conceal results.

Mines Are Mostly Worked on Contract System

Almost every mine is worked on the contract system, the *perquinero*, or contractor, buying his explosives and all his supplies from the *pulperia* (store). The contract price per quintal has nearly doubled in the last 12 months, and 60 *bolivianos* per quintal (110s. per 100 lb.) has been quoted as the most recent figure. A considerable amount of pilfering is carried on without much possibility of prevention, because anyone can buy or sell without a license. On the other hand, the prices charged at the *pulperia* are often excessive.

Explosives and supplies in general have gone up steadily in cost since the beginning of the war. Dynamite (gelignite 55%), which has the lowest quotation, costs £8 10s. per case of 50 lb. at the magazine near La Paz, with an extra charge of 10s. for conveyance to the mine. Mining steel costs £8 per 100 lb. minimum, and hammers are sold at 1s. 5d. per lb. Fortunately, the process of mining wolfram is so simple in its requirements, and the price of the product is so satisfactory, that the high charges for supplies are not seriously felt.

Labor is neither particularly plentiful nor unduly scarce, so that there is no apparent difficulty experienced on that account. Wages have appreciated to some extent recently, and the majority of mines now pay their *barreteros*, or miners, about 3.50 *bolivianos* (6s. 7s.) per day. But as most of the work is done on contract, the scale of wages gives little concern to the owners. The style of living of the Bolivian miner is of necessity rather low, owing to the cost of requisite commodities. He is an intelligent and capable worker, but he has an unfortunate weakness for alcohol.

The industry, like wolfram mining elsewhere, is regarded as a precarious undertaking, depending largely upon the maintenance of prices after the war. The present method of working—if it can be called a method—consists of nothing more than scratching up the earth and surface-holing, with the aim of getting all the ore out with the least effort and as quickly as possible, regardless of the future. There is, moreover,

no faith in the mining of wolfram in depth, which helps to account for the reluctance to do more than surface work. A few concerns will undoubtedly develop in time, but a large number must close and disappear, as some have already done, as soon as the surface deposits are exhausted. If the supply of the metal is to be maintained, there can be no doubt that the present primitive methods must give place to more scientific search and systems of production; and it may be remarked, in passing, that American interests show signs of preparing for future developments on more rational lines.

Mining Laws of Bolivia Have Not Been Modified

The mining laws of Bolivia, excellent on paper, have not been changed in any respect to meet the conditions of wolfram mining. The tenure or title is the same for wolfram as for tin, and any property of value yields a harvest to the legal fraternity in the shape of numerous *pleitos* or lawsuits. Regulations as to mining are so few as to be almost non-existent, and, in fact, the chief attention the industry attracts from the government consists in the collection of the export duty, now about 3.20 *bolivianos* per 100 kg. (about 2s. 6d. per 100 lb.), which the authorities consider to be much too low.

Other taxes are not heavy, and the duty on a mining *pertenencia* (claim) of one hectare (2.47 acres) is 4 *bolivianos* (7s.) per annum for all lode metals. The greatest advantage that wolfram mining offers in Bolivia is that little capital is necessary to start, provided that there is enough metal forthcoming to give quick returns, as there is practically no need for any plant except such as can be made on the spot at a comparatively trifling outlay. This conjunction of circumstances has been the basis of many fortunes amassed in that industry since the outbreak of the Great War. Practically all mines and prospects developed during that period started virtually without capital, supplying what was needed as time progressed from the proceeds of the output.

Available Markets for Barilla Are New York and London

The *barilla* is mostly sold in La Paz to two or three firms dealing on their own account with New York principally, and London, or with one or two government buyers for the Allies. The price paid by these latter was until recently about 65s. per unit delivered for shipment at Mollendo, but for a number of months, corresponding with the entry of the United States into the war, the price has been regulated by New York, and stands higher than the figures formerly quoted by the Allies. A 66% *barilla* not containing any objectionable element can easily fetch today at La Paz 130 to 150 *bolivianos* (227s. 6d. to 262s. 6d.) per quintal. The price varies according to New York quotations.

On presenting this review of the wolfram industry in Bolivia I must be excused for the absence of many details relating to cost of production and values per ton, for the reasons already mentioned, namely, the impossibility of obtaining those figures. Bolivia is essentially an intensely individualistic country, where little information of a trustworthy character can be gleaned without a great expenditure of time, effort, and patience.

Life of Wooden Water Tanks*

The variation in figures submitted on the life of timber on various railroads shows that no accurate estimate may be made on the life of tank timber that will apply to all sections of the country. It is characteristic of timber that it is more durable when used in the region in which it is grown than when used elsewhere, for nature seems to have fortified the timber against decay to a certain extent when it is kept in its native climate.

The accompanying table shows the life of 184 tanks that are still in service. In preparing this tabulation consideration has been given to tanks in railroad service only.

AVERAGE LIFE OF WOODEN TANKS

No. of Tanks	Material	Average Life, Years
77	Redwood	32.6
29	Cypress	28.3
25	Cypress	25.0
3	Cypress	32.0
24	White pine	29.7
12	White pine	35.4
4	White pine	29.0
184 (total)	.....	30.0

It will be noted in the table that the white-pine tanks show a higher average life than the cypress tanks, although the opposite was found to be true in a tabulation that was made of 126 tanks that have been relieved. This may be explained by the fact that cypress tanks were not used as extensively as white-pine tanks up to 20 years ago, and on the installations shown there are probably many white-pine tanks which were in use before cypress tanks were constructed, although there is apparently little difference in the durability of the two woods.

A yellow-pine tank, not mentioned in the table, showed a life of 29 years, though that of a yellow-pine tank as constructed today would probably not exceed 12 years. This difference can probably be explained as being due to the fact that the trees from which the tank mentioned was cut had not been bled of the rosin and preservative oils natural to the wood. A red-cedar tank shows a life of 28 years, but this does not represent the extreme life of the timber, for when the tank was taken down the best of the timber was used in the construction of a smaller tank, which is still in use. The original tank was constructed in 1870, which makes the timber in the smaller tank 48 years old.

Many records indicated a life of only 10 to 15 years for cypress, white-pine and red wood tanks. This was unfair to the timbers mentioned, as the short life obtained was undoubtedly attributable to poor selection of timber, poor construction, to the tank not being kept filled with water, or some one or more of a number of faults or conditions that would cause early decay.

Mine Pumps—In the General Electric Review of January, 1919, John Liston states that the pump equipment of the Randfontein Central Gold Mining Co., of South Africa, consists of four units for installation underground, each unit comprising a centrifugal pump in two sections driven by a d.c. 1750-hp., 1500-r.p.m., 2000-volt, slip-ring induction motor, a section of the pump being on each side of the motor. Each unit will have a capacity of 1200 gal. per min. against a total head of 2600 ft., which corresponds to approximately 7,000,000 gal. of water per 24-hr. day for the entire equipment.

*Abstracted from a paper presented by C. R. Knowles at the 1918 annual meeting of the American Railway Bridge and Building Association and reprinted in part in *Engineering and Contracting*.

Marketing the Mine Prospect

By E. S. BOALICH*

The seller of mine prospects is perforce optimistic. On the other hand, the prospective buyer or his "scout" is pessimistically inclined, and certain conditions and preliminary formalities are necessary that the two may meet on common ground. Primarily it is not essential that expert professional opinion of a property be obtained, for often a few well-chosen facts are sufficient to create interest and offer a basis for further investigation and business negotiations.

RECENTLY there has been a revival of interest in matters which concern the "development of the prospect." This is one of the vital questions that confront the mining world today, and not only does the subject require the thoughtful consideration of the mining public, but the intelligent solution of its various problems will have an important bearing on the nation's progress toward industrial independence.

During the last eight years I have been identified with three Federal and state "mining bureaus," and in that time my duties have brought me in constant touch with many seekers of mining information of every character. Among these there have been hundreds of prospectors and others who were in search of buyers for "properties," usually prospects and sometimes actual mines, as judged from the standpoint of development work already done. Alternating with every 50 or so of these "owners seeking to sell" has come one "prospective investor seeking to buy," or his "scout."

Attitude of "Scout" Discouraging to Prospective Seller of "Mine"

A real "scout" is a born pessimist. He may admit that there might be a mine discovered, some day, in China or Peru, or even in Mexico, but "the cream has been skimmed" in this country. The scout is world weary. A twenty-dollar gold-piece will not cause him to flick an eyelash, and a thousand-dollar bill is probably counterfeit as far as he is concerned. Why he remains in the business of "scouting" is a mystery many have sought to unravel.

A closer acquaintance with the scout and with his work somewhat diminishes one's first impression that he does not want to find the thing for which he is ostensibly looking. As a matter of fact, he has covered thousands of weary miles running down prospects and reported strikes, only to find that almost without exception the facts as originally presented to him were overdrawn, distorted, or stated in such a manner that the reported conditions could not be substantiated by close investigation. He feels, and with real cause, that the cream is not only gone beyond recall, but that the cow has stepped into the milkpail.

Ideas of Seller and Buyer at Variance

The pity is that there seems to be no middle ground, no neutral territory, where the owner of the prospect and the investor, or his engineer, may get together. The vendor is usually so obsessed with the richness and great value of his "mine" that it is difficult, if not impossible, to winnow the wheat from the chaff of his general conversation. The buyer, secure in the knowledge gained by past experience, is prone to class every man who comes to him as a visionary, and to condemn every possibility, unheard—unless it comes backed by a well-known engineer's report. Whether or not the judgment be impartial or fair, it is a fact that practically any unknown man who seeks to sell or otherwise dispose of a prospect or mine is considered incompetent until he proves himself competent, and the opportunity to speak in his own defence may even be denied him if he makes a poor beginning.

To say to the busy capitalist, "I have a 15-ft. vein which has been traced 10,000 ft. on the surface and will assay $121.50 in gold and $43 in silver," is equivalent to asking the gentleman to ring for the police. Ask him to lend you his limousine, but do not ask him to take an option on your property unless your title to the same is clear. Don't make the statement that your ore exactly resembles that of the "Golden Treasure Consolidated," for perhaps he held his stock in that company too long, and the subject does not awaken pleasant memories.

Psychology of Mine Prospect Disposal

Be prepared, however, with definite facts, "key words" as the psychologist might call them, which are capable of detailed description and proof. If your capitalist or engineer is really looking for mines, these facts will arrest his attention. He will take it upon himself to do his own prophesying in respect to what may develop and as to the width the vein may attain at depth, after he has made the journey to your particular mountain top, and has found, or failed to find, your "main workings."

Before you start to the city, Mr. Miner, take some paper and write a "report" on your mine. Do not attempt to "expert" it, but write briefly and simply what you know to be true. You will be surprised to see with what respect you and your report will be treated. As a suggestion in this connection it will be well to cover the following points:

1. Name of property; number of claims.
2. Situation (Section, Township and Range; also direction and distance from nearest town. Trail or road. Distance to nearest railroad station).
3. Title (patented or how held, with proofs).
4. Improvements and development work. (a) Surface. (b) Underground.
5. Describe deposit (vein and geologic characteristics. Size at points, where this is known. Character of ore, and pertinent ascertainable data concerning it).
6. Topography of country. Climate (in winter).
7. Reason why property is offered for sale.
8. Definite terms under which property can be purchased or leased.
9. Brief mention of history of district and names of principal producing mines.

If you have maps, assay certificates (and can show where the corresponding samples came from, and what

*Mining engineer, California State Mining Bureau, San Francisco, California.

they represent), engineers' reports, or other similar data, attach them to your statement. The first eight items outlined above offer the best argument you could ordinarily present. You will probably stand or fall by those facts. But your chances of "standing" will be much better than if you had fortified yourself with a pocketful of "high-grade," and had been hazy as to the distance to the railroad or as to whether or not you were snowed in for five months in 1918!

Liquid Oxygen Manufacture and Uses*

Speaking at a recent meeting of the Royal Institution in London, Sir. J. Dewar referred to the disappearance of the barium oxide process of manufacturing oxygen, and its replacement by that involving the fractionation of liquid air. For a time there was no demand for the nitrogen thus liberated, but soon it found extensive application in the manufacture of nitric acids and nitrates, of cyanamide, and of ammonia by the Haber process. The German dye manufacturers had exploited the electrical method of fixation and had invested about £3,000,000 in acquiring cheap water-power in Sweden. So much importance was attached to the Haber process in Germany that it had been made a national monopoly, and, in effect, it had been the principal means of enabling that country to satisfy its requirements of explosives during the war. For the Haber process the hydrogen was obtained electrolytically and by freeing water gas from admixed gases with the aid of low temperatures. In England the total output of the 12 factories manufacturing liquid oxygen was 1 million cu.ft., say 118 tons, per day, 85% of which was used for cutting and welding metals and 15% for medical purposes. In Germany one plant alone was producing 100 tons per day.

Liquid oxygen has been much used by airmen flying at high altitudes. For this purpose it is stored in vacuum vessels provided with a mechanism for controlling the evaporation, and with tubes leading to a mouthpiece through which the aviator may inhale. There are three types of mechanism. In the first, the liquid is heated electrically; in the second, the evaporation is promoted and controlled by thermal conduction through a rod of copper or aluminum in the liquefied gas; in the third the liquid is siphoned out into an evaporating chamber, from which the gas is conducted through tubes—to bring it to air-temperature—to the airman's mouth, the rate of evaporation being controlled by adjusting the conical stopcock through which the gas is passed.

Liquid air is stored in spherical metallic vacuum vessels holding from 5 to 30 gal., the high vacuum required being maintained by keeping absorbent charcoal, cooled to the temperature of the liquefied gas, in a chamber attached to the lowest part of the external wall of the inner vessel, whereby the annular space is highly exhausted. These vessels are durable, and the rate of loss from the largest does not exceed 5% per day.

The lecture was illustrated by numerous experiments, among the most remarkable of which were the demonstration of the magnetic property of liquid oxygen by placing an electro-magnet near drops of it falling from a pipette, these being drawn to the pole in the form of a thin stream; and the stopping of the motion of a radiometer wheel by creating a vacuum around it with liquid air and charcoal, the pressure being reduced to about 1/50 millionth of an atmosphere.

*Abstracted from *Journ.* Soc. Chem. Ind., Jan. 31, 1919, p. 238

Shimer Case-Hardening Process*

Case-hardening by using a liquid bath of a mixture of easily fusible salts not possessing case-hardening qualities, into which is immersed fresh calcium cyanamide, which imparts case-hardening properties to the bath, is a substitute method invented by Porter W. Shimer, of Easton, Penn. This method is said to possess case-hardening properties equal to or greater than those of previously used baths, gives off no poisonous vapors, and costs but a fraction of what the cyanide costs in the baths formerly considered essential. The process has been in use in a large American works for more than a year.

The composition of the non-case-hardening salts appears rather immaterial. Good results have been obtained by using a mixture of sodium chloride, calcium chloride, and barium chloride in equal proportions by weight; also with a mixture of one part sodium chloride to one part calcium chloride. This mixture is melted in a suitable pot, and the calcium cyanamide is brought into contact with it by placing small lumps of the cyanamide in an iron basket, which is sunk to the bottom of the case-hardening pot. A lively evolution of gas then takes place, and the bath acquires case-hardening properties, which last as long as the evolution of gas continues. As soon as a lively evolution of gas occurs, the dipping in of articles can begin. If the gas evolution becomes too great, the cyanamide may be removed, and case-hardening can be done for some time after this removal.

The cyanamide is best used in lumps, which permit of better control of the evolution of the gas. It should be fresh and contain no moisture. The quantity used varies according to the size and shape of the bath and the character of the articles to be case-hardened.

The Use of Tamping-Bags in Blasting

Miners in general realize the importance of tight tamping and the advantage of having proper tamping materials, but these are not always available, so that it may be necessary to utilize whatever is at hand, with the result that there is a greater consumption of explosives than is necessary.

Miners and rock blasters are beginning to appreciate the utility of tamping bags made of heavy paper as containers for sand, clay, or loam to be used for tamping. The bags are particularly useful when loading holes that are pointed upward. A supply of these bags can be filled and taken into the mine at the beginning of the day's work, and in this way the blaster is sure of having a tamping material that will give him maximum breakage at least cost. Their use also saves time when loading bore holes. Tamping bags are of marked advantage when the blaster desires to make up charges of blasting powder in cartridge form, as is usual when loading uppers or in damp open work. They are more convenient than clumsily made funnels or cones, for which pieces of newspaper are generally used. The cost of the bags is slight, and their use should save many times their cost because of the saving in explosives or greater breakage from a given charge.

Magnesite Production of Quebec in 1918 was 28,564 tons of dead-burned material, valued at $1,016,764, according to the preliminary report of the Quebec Bureau of Mines.

*Abstract of paper presented at New York meeting of the A. I. M. M. E., February, 1910, by Joseph W. Richards.

Mine Ventilation in the Cœur d'Alenes*

BY ROBERT N. BELL†

Consideration of the subject of ventilation in mines involves certain inevitable natural obstacles. Within set limits good ventilation by means of natural gravity air-pressure circulation may be secured, but with increased depth and lateral extension of the workings it becomes necessary to employ artificial means. The account deals with ventilation conditions in the Coeur d'Alenes and with the methods now employed and those proposed to increase and perfect air circulation in the mines.

MINES of the Cœur d'Alene district have their vein apexes high on the mountain sides, and are developed by adit or crosscut tunnels to depths below 2000 ft., which give ample natural gravity air-pressure circulations that usually afford good ventilation and are easily controlled. The natural advantages of the district in this respect, and its deep sedimentary formations, are exceptional, but in recent years, in three particular cases, the ore penetration has been developed extensively below the lowest points of surface-drainage entry, involving crosscut tunnels, three of which are two miles long. These tunnels are of a minimum size of 7 x 8 ft. and are used for drainage, haulage, and ventilation.

Ore Persistence at Depth Presents New Ventilation Problem

Above these deep drainage levels, ventilation by natural gravity air currents was a simple matter, but each of these mines, and several others in less degree, have shown a persistence in their ore occurrence to great depth below these lowest drainage entries, and the sublevels thus developed have rapidly expanded in the last few years. This condition presents a new problem in ventilation. The long tunnel is depended upon for the main air supply by reason of the fact that the electric ore-trains used in these air courses act like a piston and offer resistance when in motion against the air, and materially retard its flow.

Sublevel ventilation by natural gravity air, even with the advantage of deep drainage and numerous higher outlets, has recently proved inadequate in volume and velocity fully to supply the normal working requirements of the men, and mechanical means for increasing the air supply have become imperative.

A ventilating system that will simply carry away the smoke and gases resulting from blasting, and the emanations from men and lights, is a mistaken economy in large mine operation, as the great harm resulting from an insufficient supply of good air is shown markedly in the behavior of the men employed in such a mine. "Surliness, discontent, inefficiency, and a general desire to cut work or taper" are often directly traceable to poor air, and no investment will pay a bigger return in resulting efficiency of the workers than good ventilation.

The long tunnels of the Morning and Bunker Hill & Sullivan mines, owing to the natural wall resistance and moving trains, are incapable of carrying sufficient air properly to ventilate the extensive and rapidly deepening sublevels of these properties without mechanical induction. Fortunately, both mines have several other outlets in addition to their long tunnels, which, though at a much higher level, can be used and are used as additional sources of fresh air, with the return or up-cast draft directed through still other outlets. To improve ventilation conditions at these properties it is necessary to drive several thousand feet of expensive straight-line raise connections, in addition to making the required mechanical installations, but scarcity of labor has decidedly retarded the improvements.

Proposed Ventilation at Bunker Hill Mine

In carrying out the work of making the connection, over 900 ft. of raises have been driven at the west end of the Bunker Hill mine, and these are now being extended, to be used exclusively as an air course. A station has been cut for the installation of a recently ordered 60,000-ft. Sirocco fan to take fresh air not only from the Kellogg tunnel, but also from the adjacent Sweeney shaft and other west-end outlets. Present plans provide for, if it is found necessary, the installation of another large Sirocco fan near the head of the No. 2 east shaft, which is up-cast and will afford a permanent circuit through the east-end outlets, above the Kellogg tunnel. This is the deepest mine along the plane of the vein in the Cœur d'Alene district. Its orebodies are entirely in quartzite formation and vary in size up to 100 ft. in horizontal cross-section and 900 ft. in length. Stopes are timbered with square sets and filled with waste. Levels are 200 ft. apart vertically and 300 ft. on the dip of the vein, which is about 40°. The hottest stope in the mine is 1500 ft. above the bottom level at the apex of the Cameron stope at the No. 10 level crosscut connection. This is one of the largest stopes in the mine, and has been actively operated for the last 12 years. At this point the temperature is 80° and the humidity reaches 100%. This is largely due to local faulting, oxidizing timbers of the stope and the fact that the situation is a converging point of return air.

Range of Temperature at Bunker Hill Mine

The highest bottom-level temperature in the mine at the new 15 level, which is 4800 ft. along the dip of the vein below its highest crest and 3400 ft. vertically under the mountain, registered only 70° F. The top of the stopes at 13 and 14 levels registered 75°, and the No. 2 shaft station main-return air course at the 13 level, 70°. These are comparatively low temperatures for such depths. The mine, however, is damp throughout, and the relative humidity is high in all the sublevels, causing men to perspire freely at work, and this gives the impression that the temperatures are higher than is actually the case. The only remedy for this humid condition is a greater volume and velocity of fresh-air currents.

At the Hercules mine, with a drainage crosscut tunnel at its lowest point from Canyon Creek only a few hundred feet short of two miles in length, the natural

*Abstracted from "Twentieth Annual Report of the Mining Industry of Idaho."

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ventilation in its new sublevels is still good. The new vertical, four-compartment shaft from this level is 1400 ft. deep, but only three sublevels have yet been opened down to the 600 level. The underground hoist stations are completely sealed with air-tight doors, and the main shaft, which during the winter carried 30,000 cu.ft. per min. of fresh air, affords ample ventilation for the present levels. By way of the shaft, drifts, stopes, and through several rock raises to the No. 4 tunnel outlet, 600 ft. above No. 5, a natural return circuit is provided during the summer season. Stations are now being cut in the new shaft at the 800 and 1000 sublevels, where the natural temperatures are slightly under 70° and well ventilated by an exhaust fan at the 600-level station.

Deep Working Shaft at Hecla Mine Provides Natural Ventilation

The Hecla mine has a natural advantage in ventilation, owing to fact that its main working shaft starts at the surface and does not involve a long adit approach. It is ideally situated for natural gravity air ventilation, and the management has taken full advantage of this condition. The mine has a drainage level driven along the course of its ore zone several thousand feet, which strikes directly into the east side of the abrupt slope of Canyon Creek, near the main surface shaft collar. The main shaft now has a maximum vertical depth to its new bottom station of 2000 ft. The lowest operating level is at a depth of 1600 ft. and the lineal distribution of the orebodies is extended 3000 ft. in length and duplicated with several parallel courses of ore, with many raises, chutes, and manways at short intervals. Near the east end of the ore development a straight-line raise, nearly vertical and 1400 ft. high, was put through to the surface from the drain tunnel, for ventilation purposes, and the opening gives a maximum gravity vertical range to the 1600 level, through connecting raises, for a natural air quantity of 3000 cu.ft. per min., with several other outlets above the drain tunnel to relieve the main west stopes, and this theoretically presents almost ideal conditions for natural air circulation.

Heavily Timbered Drifts Offer Resistance to Ventilation

The main shaft has a large-sized compartment which is idle, and each station drift entry is provided with an air door. In December this shaft, acting as a natural down-cast, was distributing 28,000 cu.ft. of fresh air per min. at strong velocity through the lower levels, with return through numerous outlets to the surface. The recent rapid expansion and duplication of the operating avenues and ore courses of this mine, all heavily timbered, develop a heavy resistance to free air circulation, in spite of its extremely high-chimney draft value, and retard the flow of the return air, which is believed to be due, in part, to lack of proper splits in the west orebody, a condition that the company's engineers are now studying carefully with a view to remedying by additional doors and stoppings, and if this is not effective, a powerful Sirocco fan will be installed as an exhaust, probably at the head of the No. 3 tunnel 1400-ft. raise.

The temperature at the new 2000-level station in this mine in December was 70°, with relatively high humidity. In common with all the other sublevel properties, the maximum or warmest place tested in this mine, owing to the same cause of temperature localization as in the Bunker Hill & Sullivan and Morning mines, was at the top of an exhausted stope on the 600 level, 1000 ft. above the bottom working level, which gave a reading of 70° Fahrenheit.

It would seem from the foregoing that the temperatures in the deepest mines of the Cœur d'Alene district are comparatively low, and are approximately the ordinary normal summer heat at the surface. There is prevailingly, as previously stated, however, a general dampness of the ground and the resulting humidity or moisture in the air.

Air Conditions Improved by Blasting Schedule

At the Bunker Hill & Sullivan mine, the stoping is all done on day shift, and at the other mines the bulk of it is done on day shift. When two shifts are working in the stopes, the blasting is practically all done at the end of the second shift, which permits 8 to 16 hours' time for the mines to clear of smoke and gases resulting from the blasts. Exhaust fans are invariably used in dead ends, and there is now no point in the district where the air fairly can be considered bad, but in several of the properties, at the end of a shift with a big crew of men working, the air is poor, and it can be greatly improved by mechanical installations and new connections designed to facilitate the distribution of the currents.

Cost of Thawing Water Mains*

Data on the 1917-18 experiences of 96 cities with frozen water mains and services are included in the report of a special committee of the New England Water Works Association. The methods employed by these cities in thawing are summarized as follows:

ANALYSIS OF METHODS OF THAWING

	Mains No. Cities	Services No. Cities
Electricity	36	31
Steam	8	8
Hot water	4	11
Electricity, hot water	5	24
Electricity, steam	5	6
Electricity, hot water, steam	2	10

One city reported that the blow torch was employed in thawing services; another city employed fire. The cost of thawing with electricity per job varied from $20 to $1. A summary of the cost is as follows:

COSTS OF THAWING FROZEN WATER MAINS BY ELECTRICITY

No. Cities	Reported Cost	No. Cities	Reported Cost
3	$20	10	$10
1	18	3	$8 to $10
3	$15 to $16	21	5 to 8
3	12	6	3 to 5
2	11	5	Less than $3

The cost of thawing with steam ranged from $4.50 to $75, the later figure being reported by Stamford, Conn. One city reported a cost of $5, one a cost of $17.70, one $20, one $9.41, one $7.63, one $4.50, one $7.50, one $6.50, one $16.50, and one $14.

The reported cost of thawing with hot water ranged from $2 to $20. Four cities reported the cost as being $2; one a cost of $2.67; three a cost of $3; five a cost of $4 to $5; three a cost of $5 to $6; one a cost of $11.20; one $14, one $17 and one $20. One city reported the cost as being 5c. per ft. of pipe thawed.

Three cities reported on the cost of thawing by fire. In one case the cost was $11.16, in another $10.69 and in the third $10 to $30.

*Abstracted from the *Canadian Engineer*, Jan. 23, p. 166.

The Radium Industry and Reconstruction*

BY JOHN S. MACARTHUR

THE production of radium is one of the few industries that have been started under Government auspices. The Joachimsthal pitchblende deposits on which Mme. Curie experimented were worked by the Austrian government, which furnished material for the experiments. It may be objected that, as at this time all the available supplies of radium were being used for experimental purposes, no industry could, properly speaking, be said to center about it. In a short time, however, as the result of experimental work, the importance of radium as an article of commerce came to be realized, more especially in France and Germany, and its production acquired the status of an industry. A similar development had begun in Britain and in the United States when war broke out.

The production of radium, like that of almost every other commodity, has been profoundly affected by the conditions that have prevailed during the last four years. The Joachimsthal pitchblende, which had been the main European source of supply, ceased to be available. Ore had, therefore, to be obtained from overseas. The shipping problem was a dominant factor in the situation, and hence the importation of material from Australia and India was practically barred. There remained the carnotite ores of Utah and Colorado, and these have furnished Britain and her Allies with radium since 1914. These ores had previously interested British manufacturers, and, in consequence of the Allied blockade of Germany, supplies of ore and low-grade concentrates, which formerly went there, found their way to Great Britain in the early days of the war. Besides radium minerals for treatment in Great Britain, considerable quantities of highly concentrated radium compounds were imported to that country from the United States.

Much valuable shipping space might, however, have been saved had it been found possible to make use of considerable quantities of radioactive ores which are known to be in Cornwall. The records of pitchblende production in that county are admittedly imperfect, and this imperfection accounts partly for the failure to appreciate the importance of Cornwall as a producer. What it might do may be judged from the fact that one mine alone, to the records of which I had access, produced, in four years, ore which contained radium equal to 18,000 mg. of radium bromide, an amount comparable with the output of all the carnotite fields of America in the first four years of active production.

For the last four years practically all the radium produced in and imported into Great Britain has been for government purposes, and although radium was not actually "controlled" until August, 1918, the conditions for obtaining raw material and labor were such as to insure that the output went to the government. What, then, will be the effect, on the radium industry, of the cessation of hostilities? Unlike other industries, it cannot be said to have an established prewar position to which it can return. In my opinion it will have three main channels of development: In the first place there is radio-therapy; secondly, the manufacture of luminous paint; thirdly, the use of low-grade radium residues as fertilizers.

Not long after the discovery of radium, the similarity of its radiations to the X-rays suggested that it might be of use in medicine. Accordingly it was soon possible to obtain radium water, mud, or vapor baths at various Continental spas, which established "emanatoria." The treatment was used mainly for rheumatic subjects and neurotics. It is hardly remarkable that the multitude of adventitious aids to bodily and mental well-being which are to be found at such resorts tended to obscure the real nature of the curative powers of radium; but in other quarters radiotherapy was being taken much more seriously. It was discovered that radium is effective in arresting some forms of malignant disease, and much successful work was done in this connection, and a steady market had just been created for the radium producer when war broke out in 1914. A natural consequence of the war was that the progress of radio-therapeutics was much delayed, through lack of workers and shortage of material.

Less, therefore, has been done in defining the possibilities and limitations of radium as a curative agent than might reasonably have been expected five years ago. In war surgery, however, radium proved useful for preventing adhesions after wounds, and for rendering the scars pliable. In the case of facial wounds this has the effect of greatly lessening the disfigurement which they so often involve.

In the near future there will be a large demand on the part of the medical profession for radium, not only for the treatment of diseases where it is known to be of service, but also for doing experimental work, for here the time lost during the years of war must be made up. So important has this application of radium seemed. that medical men have advised the Government of the United States to see to it that the whole of the radium supply in that country is reserved for medical purposes alone. They regret that so much of the limited supply of radium should be dissipated in the manufacture of luminous paint for such things as watch dials, electric bell pushes and other like uses.

This brings one to the second great field of activity for the radium producer—namely, the manufacture of luminous paint. This substance is made by mixing a small quantity of a radium salt with hexagonal zinc sulphide. The luminosity of such a preparation is not conditional on previous exposure to light, and the activity of the radium is not lessened by its being mixed with the zinc sulphide. The cost of the mixture is not prohibitive, as 0.4 mg. of radium bromide to 1 to 2 gm. of zinc sulphide is sufficient to give good luminosity. The paint, however, is efficient for only about two years. By that time the zinc sulphide is worn out by the bombardment of the radium radiations. The latter is not exhausted, but may be isolated and used again with fresh zinc sulphide.

Though it is desirable that as much radium as possible should be available for the medical profession, and that it should not be wasted on articles of luxury, the legitimacy of its use for illuminating ships' compass cards is rather a different question. It has been suggested that mesothorium might profitably take the place of radium in the manufacture of luminous compounds.

*Abstracted from the *Mining Journal*, January 18, 1919, p. 39.

The radioactivity of this element is for practical purposes comparable with that of radium, but its life is measured by years, not centuries, and it could not with advantage be isolated more than once or twice.

There remains the use of low-grade radium residues as fertilizer. These residues, still containing a small quantity of radium, have been found to exert a stimulating influence on plant growth. The precise nature of the stimulus is not absolutely known, and has been hotly disputed. Some have denied the beneficial influence of radium altogether, but the weight of experimental evidence appears to be against them, and it is found that there is a steady demand for radium residues on the part of agriculturists and horticulturists. Radium fertilizer must not be thought of as a food; it will not take the place of essentials such as phosphate or potassium, but will aid in their assimilation. It also seems to assist in the fixation of nitrogen. The production of radium fertilizer remains of course the same, whether the concentrates are used for medical purposes or for preparing luminous paint.

Whether or not the production of radium is a key industry is a question which the mere scientist may think it presumptuous to answer; but it certainly ought to receive the attention of those who are devoting themselves to the solution of the problems of reconstruction. The position with regard to ore may be summed up as follows: The Joachimsthal pitchblende supplies, which showed signs of failing before the war, are now almost exhausted, and the United States Government has placed an embargo on the export of radioactive ores. The British manufacturer of radium must therefore seek his raw material elsewhere. Cornish supplies are extensive, but require re-development. Promising reports of radium minerals come from India, South Australia, and East Africa. It is of immediate importance that these supplies be developed to their fullest capacity.

Anything like a full description of radium extraction would be far beyond the limits of this paper, especially as methods must vary according to the nature of the ore that is being treated. All methods take advantage of the fact that barium and radium are chemically homologous. If barium is not already present in the ore, it is added in an insoluble form—1 kg. of barium to 1 mg. of radium—that is, 1,000,000 to 1. If the ore is then treated for barium, the radium will also be recovered. How far the power of barium to entrain radium is due to absorption has not yet been definitely ascertained.

When the radium and barium have been recovered together in solution as chlorides, the whole is evaporated to saturation point. The crystals which settle out are found to be much richer in radium than the radium-barium chloride left in solution. By repeated crystallizations an almost pure radium salt can be obtained.

American Smelting and Refining Co.

The earnings of the American Smelting and Refining Co. and its subsidiary companies for the fiscal year ended Dec. 31, 1918, after deducting general expenses ($1,305,934.39), corporate taxes ($1,252,356), and fixed charges ($1,616,109.44), aggregated $14,137,167.65, or $10,898,770.79 less than the preceding year. Corporate taxes were $2,597,614.73 less than in 1917. From these earnings, $5,439,631.20 was further deducted for depreciation and depletion, $250,000 for safety and welfare reserve, and $740,038.22 for miscellaneous charges, leaving $7,707,498.23 as total earnings applicable to dividends.

The company's income was derived as follows: Net earnings of smelting and refining plants and dependent industries, $13,234,710.85; net earnings from mining properties, $2,686,839.73; interest, rents, dividends and commissions, $2,390,016.90; total gross income, $18,311,567.48. Economic conditions that had maintained throughout the previous two years continued during 1918 and were accentuated in the last half of the year by constantly increasing wages and cost of fuel, materials, and freights. There was also a still further decrease in the efficiency of labor, due to the influenza.

Of the $7,707,498.23 applicable to dividends, the amount declared on preferred stocks for the year 1918 totalled $4,247,773.75, leaving $3,459,724.48 applicable to dividends on common stock. For the first three-quarters of the year dividends were paid on the common stock at the rate of 6% per annum and for the last quarter at the rate of 4%; the total paid being $3,354,890. The balance of $104,834.48, together with the surplus on Dec. 31, 1917 ($26,955,394.40), brought the total surplus to $27,060,228.88.

During 1918 there was expended $4,916,971.92, which was charged to property account. This included about $1,300,000 which was invested in Mexico and Chile, and $340,000 for the purchase of a mining property in this country.

The following statistics relate to plant operation during 1917 and 1918.

OPERATING STATISTICS: AMERICAN SMELTING AND REFINING COMPANY

	1917	1918
Number of men employees, excluding Mexico	24,698	21,765
Total wages and salaries, excluding Mexico	$24,497,836	$25,516,467
Average wages per 8-hour day	$3.31	$3.91
Tons charge smelted	5,918,924	5,658,232
Tons bullion refined	706,875	680,099
Tons coal used	787,890	765,124
Tons coke used	592,765	545,063
Barrels fuel oil used	1,560,535	1,659,337
Cubic feet gas used	3,032,908,373	2,372,000,103
Tons ore mined	2,318,925	2,525,280
Tons coke produced	186,107	171,245
Production:		
Gold, oz.	2,496,693	1,994,015
Silver, oz.	69,841,061	72,572,506
Platinum and palladium, oz.	1,597	1,516
Lead, tons	275,266	260,192
Copper, lb.	916,974,000	868,540,000
Spelter, lb.	52,522,000	41,238,000
Nickel, lb.	682,715	626,085
Tin, lb.	12,130,000	19,868,000
Sulphuric acid, lb.	66,174,000	87,338,000
Arsenic, lb.	9,132,000	7,837,063
Copper sulphate, lb.	7,598,000	5,164,000
Byproduct metals, lb.	4,131,709	1,870,662

Negligent Ladder System in Shaft

BY A. L. H. STREET*

A North Carolina mine owner has been held by the Supreme Court of the state to be liable for the death of a miner, who was killed while descending a ladder in a 550-ft. shaft, through being struck by other miners who fell upon him, where it was found that no platform was maintained on the last 95 ft. of the lower end of the shaft where the accident occurred.

Witnesses testified to a general mining practice of constructing platforms at least every 25 ft. in such manner that any person or substance falling along the ladders would lodge on a platform. Absence of such platforms on the lower 95 ft. having permitted decedent to fall about 75 ft. to the bottom of the shaft, it is held that the jury properly found that defendant operator was guilty of actionable negligence. (Parrish vs. Richardson, *97 Southeastern Reporter, 225.*)

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Operations at the Zinc Camp, Arkansas

By TOM SHIRAS*

Few mining districts can boast the distinction of paying their way from "the grass roots." The Zinc camp is one of these, and, moreover, owes its success and activity to the removal of the lumber industry, which formerly supplied local labor with a means of support. The ore deposits are not complex, mining may be carried on economically, and the returns are in good proportion. Operations are mostly in the hands of small concerns.

THE Zinc camp, which covers a territory approximately 10 miles square in North Boone County, Ark., including the upper watershed of Sugar Orchard Creek and a part of Crooked Creek, is interesting from the fact that practically all of the development work, which has resulted in the opening of many small mines, has been paid for from production, and there has been little investment of capital. The village of Zinc, situated in the Sugar Orchard Valley between two timber-clad ridges, is the headquarters for the mining men of the camp and the shipping point for the ore.

Opportunities for the Small Operator

The camp occupies the same position in its relation to zinc mining as the old placer camps of the West did to gold. No one person or corporation owns all of the land; no company commissary exacts high profits for supplies, and any man with a strong pair of shoulders, a few pieces of hand steel, a striking hammer, picks and shovels and a wheelbarrow can nail a lease at a reasonable royalty and throw his hat into the ring. Considering the camp as a unit, it is ultra democratic and warm hearted; it welcomes a real miner spontaneously and enthusiastically, and it will fold a "busted tenderfoot" to its breast; but the stockjobber receives a cold welcome. Like other camps, it has its "monuments," but most of these are due to incompetency or the lack of practical knowledge of mining. Local men who follow mining as a business, and others who have come into the camp, have made a success, and this is particularly true of the small operator—so much so that the district has gained the sobriquet of "a poor man's camp."

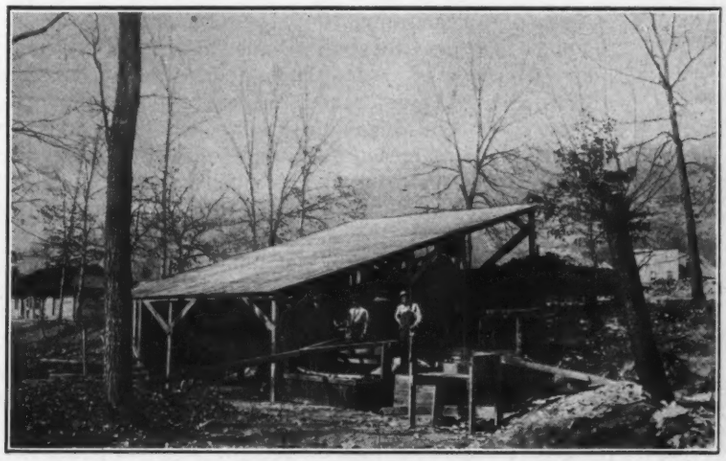
Geology of Sugar Orchard District

John C. Branner, former State Geologist of Arkansas, in his report of the Sugar Orchard district, chronicles its geology as follows: "In its main features the geology of the Sugar Orchard district is quite simple; the horizontal calciferous rocks which yield the zinc are overlain by the St. Joe marble bed, and, above the St. Joe, the Boone chert caps the hills on both sides of the streams. There appear to be local variations in the beds, at places the structure being obscured by deep decomposition."

Mining Confined to Removal of Siliceous Ores

Practically all of the ore mined in the camp is silicate of zinc carrying from 40 to 45% metallic zinc, with no lead, sulphur, or other objectionable substances. It is found disseminated in the gangue and in nugget form, the former requiring crushing and concentration, whereas the latter is ready for the market as it comes from the ground. Associated with the siliceous ores are large bodies of tallow clay, which carry from 20 to 35% metallic zinc, for which no market has yet been found. Sphalerite, or jack, has been discovered at lower levels by deep drilling in the valleys; but the presence of large bodies of silicate ore at the grass roots above the water level has discouraged the development of the sulphide mineral, and it is likely that it will receive little attention until the silicate ores are exhausted.

Silicate ore, being a secondary formation, is more frequently encountered along the sides of old underground water channels, breaks, and faults. When once the ore is found, the miner follows it up or down to the right or left until the mineral pinches out. Until two years ago, a popular theory in the camp was that the ore rimmed the hills for a depth of about 70 ft.



McCURRY CUSTOM MILL AT ZINC, ARKANSAS

GLORIA MINE AND MILL AT ZINC, ARKANSAS

*Mountain Home, Arkansas.

and that it was useless to cut deeper than that, as limestone bars were encountered at that depth and cut off the ore. However, this theory has been disproved, for some of the richest tunnels in the camp are now back as far as 500 feet.

Increased Mining Activity the Result of Lack of Work

Though prospecting has been carried on in the camp for the last 30 years, and a little production was made during that period, the camp did not come into its own until 1913, when it was literally forced into production by reason of circumstances that made it absolutely necessary for the male part of the community to mine. Previous to 1913, promoters would appear periodically, lease or buy a property and promote it. Invariably thousands of dollars were spent, and there were no returns. The industry was so spasmodic that it could not be depended upon as a means of furnishing local labor with steady work, and most of the men in the community were employed by a number of sawmills in the vicinity of Zinc. Late in 1912 these mills completed operations and moved away, leaving local labor idle and stranded. The men were without sufficient money to provide the necessaries of life, and possessed no funds with which to move away, and socialism became a popular topic of conversation. One night early in January, 1913, Lon Brown, a local prospector, walked into a store where the male population of the village had gathered and were bewailing their lack of luck, and offered every man $1.50 a day to mine silicate on a lease he had lately taken at the mouth of Coon Hollow. The only strings tied to the job were that the men would have to bring their own picks and shovels, and look to the ore pile for their wages. Most of them laughed at his proposition, believing that mining could not be carried on without a big initial investment, but four or five met him at his prospect the next morning, scraped the snow out of the cut, and started to work. In two weeks' time they produced a carload of hand-cobbed silicate that brought $700 in spot cash, which was more real money than had been in the village for months. Immediately silicate mining became popular, and the community has lived and thrived from the industry ever since.

Shafts have been sunk at a few properties in the camp, but most of the mining has been done by driving tunnels into the mountain sides on the ore-bearing level, the tunnel sites being determined by the ore outcrops.

Development of Milling Facilities

For the first few years hand-cobbed ore was the only grade produced. However, in taking out this free ore large quantities of milling ore were removed, which could not be treated, because of lack of proper facilities. This condition was overcome in 1915, at which time the McCurry custom mill was constructed, and later the Brown mill, which is now owned by the Boo-Gra-Loo Mining Co. Other properties in the camp which are now equipped with mills are the Madison, Resin Jack, Coker Hollow, Tar Kiln, Red Mill, and Gloria. The first four run spasmodically and the latter two, together with the custom mills, are in steady operation.

The Gloria mine, operated by the Gloria Mining Co. under the management of George Miller, is the largest producer in the camp, and was the largest producer in the field last year. It represents the type of mine into which many of the smaller properties will develop under proper management. The work has been carried on through a series of tunnels, of which there are nineteen. The mine proper lies on the east side of Sugar Orchard Creek about ¾ mile north of Zinc, and consists of approximately 1000 ft. of tunnel and crosscuts. The main tunnel, which is 15 ft. wide, has been cut under the mountain for about 500 ft. The last 200 ft. extends through a body of silicate ore 36 ft. high and of undetermined width. After hand picking the free ore, the "dirt" shows a mill recovery of 25%. Headings in a number of crosscuts are also in good orebodies, but these do not compare with the extent or richness of the body cut by the heading in the main tunnel. Owing to the price of ore, the owners of the property have made no effort to produce a maximum tonnage, but have confined their operations to blocking out their ore, and have milled and sold only such output as was produced by the blocking-out of ore. Production has been from 20 to 40 tons a week.

The property is equipped with a small but modern concentrating plant. The machinery consists of one 10-in. crusher; one set of 24-in. rolls; 2 sets of 18-in. rolls; one 4-cell rougher jig; one 5-cell cleaner jig; and 2 Wilfley tables, with the necessary screens, belting, elevators and other equipment. The mill was operated for a number of years without a set of cleaner jigs or the tables, the cleaning being done with hand jigs, but under this method a considerable part of the valuable minerals was lost. Since the installation of the new cleaning equipment, the chats made by the old method have been re-run, and a profitable recovery has been made.

Measuring Gas Temperature in Boilers*

Accurate measurement of the temperatures of the gases as they pass through a boiler setting is extremely difficult, especially where the temperature of the gases differs greatly from that of the surrounding surfaces. Under such conditions the results obtained by ordinary methods of measurement are seldom correct within less than 10%, and are frequently off 25%. The errors in the measurements are due chiefly to three causes, as follows:

1. Radiation from the instruments with which the temperatures are measured. This error usually makes the observations too low.
2. Variation of the temperature of the gases at different points in a cross-section of the path of the gases. This error may make the readings too low or too high; more often, too low.
3. Fluctuation of temperature at any one point may cause the reading to be too low or too high.

Iron Works in the Donetz Basin of Russia are practically intact, and with some repairs would be able to resume operations immediately if the conditions permitted, according to the *Ironmonger*. Last August the blast furnaces of Krivoi Rog at Gdanzevski, were undamaged, but only 400 men remained at work. At the Briansk works 2500 men out of 6000 and at the Druzhkovka works 3000 men are employed. The Dnieproviénne Co. has kept on its men at the Kamenskoi furnaces, and it is possible that work may soon be resumed there.

*Abstracted from *Bull.* 145, "Measuring the Temperature of Gases in Boiler Settings," by Henry Kreisinger and J. F. Barkley, Bureau of Mines, Department of Interior.

The Guamoco District of the Republic Of Colombia—II*

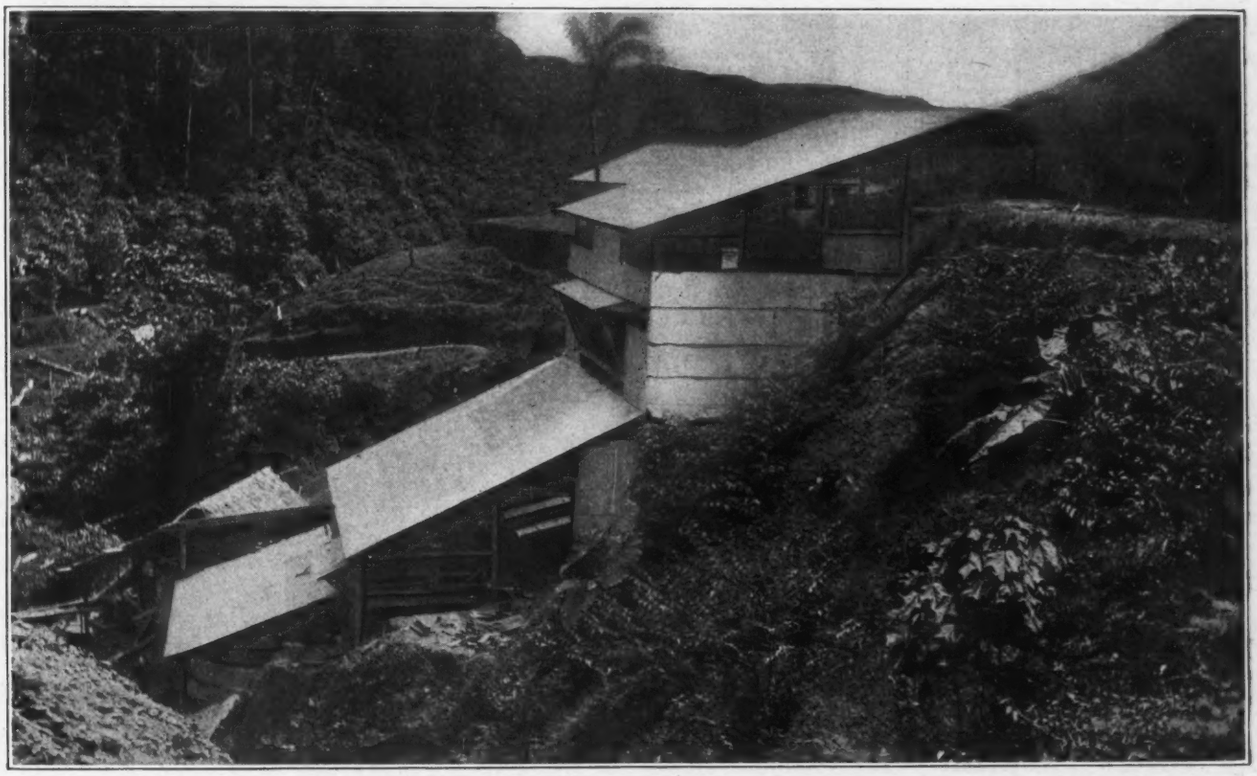
By S. FORD EATON†

CONDITIONS are extremely trying in the early stages of development in a locality such as the Guamoco district of Colombia, although, with time and organization, difficulties can be greatly modified. Transportation, obviously, is the principal problem. Distances from the two main rivers are great, and the country is rough. By looking at the map one would, perhaps, think that some shorter and more feasible routes must exist, but none has been found. Inasmuch as the mountain ranges run north and south, trails for freight trains must, for the most part, go in the same direction to avoid numerous heavy climbs. Favorable passes to the east or west are not plentiful. These trails are expensive to build and maintain. They must be cleared, graded, and banked on the hills, not only to make the long climbs easier but to drain off the water from the continuous rains. Pastures for stock must be cleared, sown, and fenced at regular intervals of a day's travel for pack trains. A train will make about 10 miles a day, and a rest house must be built at each station. Pastures and trail must be gone over at least twice a year to keep down the rank tropical vegetation. The constant rains and mule travel cut the roadbed rapidly, so that repairs are always needed, and fences and houses must be kept in proper condition.

Supplies, machinery, and repair parts must all be packed in anticipation of mule-back transportation. A mule load or *carga* cannot be over 250 lb. in two parcels, Pieces heavier than this, up to 500 lb., can be brought in by *turega*, i.e., lashed on two parallel poles, and supported by one mule in front and another behind. Still heavier pieces can be brought in on poles by men, but this mode is extremely slow and expensive.

The number of mules for hauling freight should be such that there is always at least one extra train or *partidua*, thus allowing a resting period for shoeing and treatment of sores and cuts. A good pack mule can be bought for about $100. Oxen can be used, but they are not as good as mules. The purchase price is less than half that of the mule, but they travel more slowly, require more pasture, are harder on the trail and will not stand up as well under constant work. Oxen will, however, travel with a heavy load over a swampy, boggy trail on which a mule will experience difficulty even without a pack.

Supplies must be ordered long in advance, because, in normal times, it takes from three to six months to get them from the United States. From Colombian centers the time required is from six weeks to four months. This is not a serious drawback after the preliminary installation, as regular needs can be anticipated, but at the start and in emergencies many aggravating delays are experienced.



THE LIBERTAD MILL, REPUBLIC OF COLOMBIA

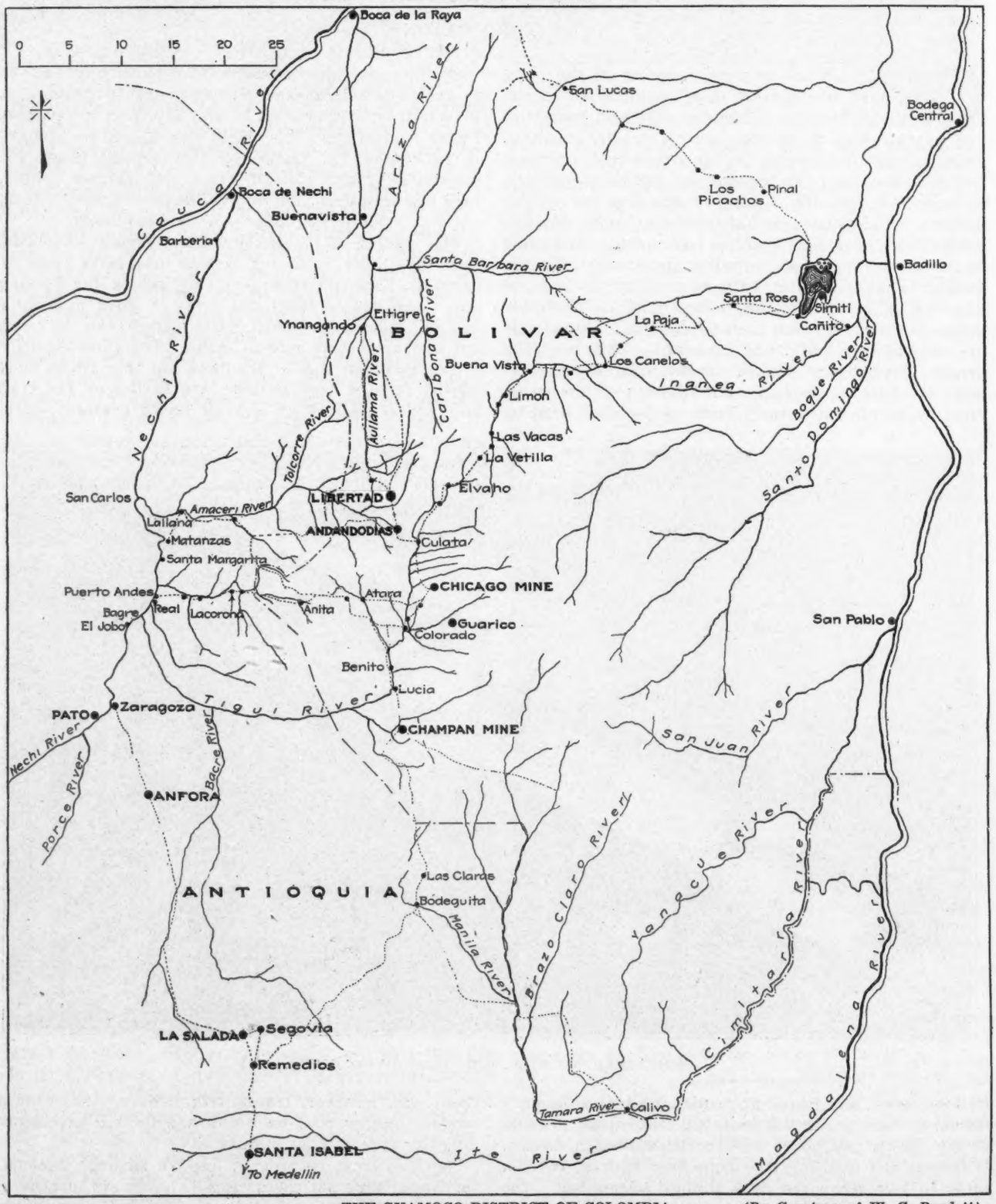
*The concluding installment of an article that appeared in the Mar. 22 issue of the *Journal*.

†Consulting mining engineer, Rocky Mountain Club, 65 West Forty-fourth St., New York.

Water power is available everywhere, and can usually be applied direct. Most of the mills have used water in this manner with turbines or the huge native type of overshot wooden wheel. A small hydro-electric plant supplies the needs of the Guamoco Mining Co. The available horsepower is almost unlimited.

Native labor, such as it is, is plentiful. In this particular district there are two classes or factions. One comes from Simiti, the lowlands, and the other from Antioquia, the highlands. The Simitenian is a riverman, fisherman, and farmer of sorts. He is ignorant and somewhat stupid, but, to a certain extent, conscientious and trustworthy about his work. His knowledge of quartz mining has been gained in the mines of Guamoco during recent years. On the trail, and in carrying out clearing and general jungle work and at packing over hard trails he is a good workman.

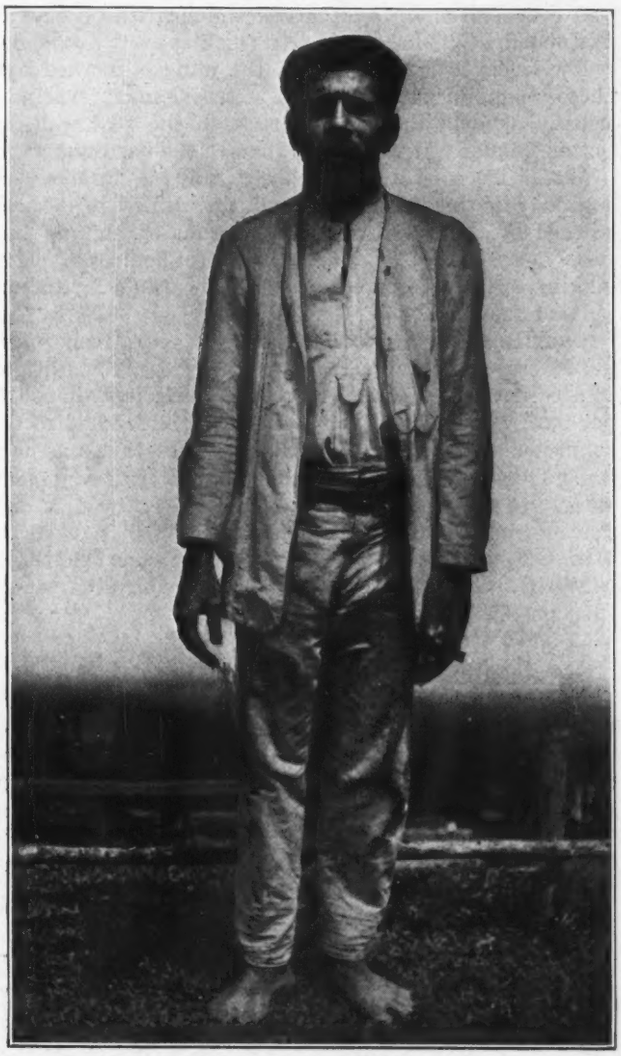
The Antioquian comes from a district where con-



THE GUAMOCO DISTRICT OF COLOMBIA *(By Courtesy of W. C. Burdett)*

siderable quartz mining is carried on; consequently his knowledge of the work is greater. He is a more intelligent and enterprising worker, but wiser, and inclined toward trickiness and shirking. He is more energetic and efficient than the Simitenian, and consequently makes a better boss.

The Guamoco population is composed of the lowest class of these two factions. Enmity exists, but by maintaining an equal balance of numbers, and by treating them impartially, serious trouble can be avoided.



A MINE BOSS FROM ANTIOQUIA

They have no morals. Petty deceit and dishonesty are the rule rather than the exception, and the majority are heavy drinkers. Nearly all live for the day only; and thought for the future is conspicuous by its absence. Patience is the basic requirement for successfully handling these natives, and they must be treated as grown-up children. Brutal, domineering tactics do not produce the best results; but, on the other hand, the fact must not be overlooked that they are always ready to take advantage of slack supervision.

Liquor causes the greatest trouble. The natives insist on having it, in spite of all precautions and regulations to the contrary. Experience has shown that it is better to have it available on the property and to regulate the sale as seems best for all concerned.

Generally speaking, some system of task, bonus or contract work will produce the best results, because on day's pay there is a tendency to loaf. Carelessness and shirking can best be overcome by imposing fines. Deducting some of his pay will impress a native far more than a reprimand or even a jail sentence. In this connection it is wise to make the administering of fines a public matter. Posting them on a bulletin board helps to impress the culprit and causes his fellow workmen to avoid making the same mistake.

Guamoco wages are higher than in other districts. This condition is due to the fact that, in the early days, it was necessary to offer a bonus to the natives to induce them to come to the district; and the scale has never been reduced. Of their wages, 45c. per day is deducted and is issued in food as a ration. The rates of pay are as follows:

TABLE I. WAGES PAID IN GUAMOCO DISTRICT OF COLOMBIA

Surface laborer, per day	$1.00 to $1.20
Surface boss, per month	45.00
Carpenter, per month	60.00
Mechanic, per month	60.00
Blacksmith (general), per day	1.50
Millman, per day	1.20
Helper, per day	1.00
Electrician, per month	50.00 to 60.00
Helper, per day	1.20
Mine foreman, per month	70.00
Assistant foreman, per month	60.00
Timberman, per day	1.30 to 1.50
Miner, per day	1.00 to 1.30
Mucker and carman, per day	.90 to 1.20
Tool sharpener, per day	1.20
Nipper, per day	.80 to .90
Storekeeper, per month	50.00
Mule skinner, per month	40.00
Helper, per month	30.00

Food

Owing to the fact that settlements or supply points are few and far between, the traveler, prospector, or miner must supply everything required by himself and natives. The native "on his own" can subsist on very little, and his wants are few, but when he goes to work for a company which provides all food he quickly develops a finicky streak.

Companies Encourage Local Production of Foodstuffs

The companies have encouraged responsible natives, with agricultural experience, to clear and plant farms where the conditions were favorable. Guamoco now produces nearly enough corn, plantains and *yuca* for local needs, as well as considerable sugar cane. The other essentials are rice, beans, coffee, lard, cheese, salt, beef, and tobacco. *Panela* (brown cane sugar) is consumed in large quantities, and for the most part is brought in from Simiti. Usually there is a shortage of corn during the months of April and May. At such times the grain must be brought in from the river districts,

TABLE II. RETAIL COSTS OF FOODSTUFFS AT GUAMOCO CO.'S STORE

	Per Lb.		Per Lb.
Corn	5c.	Coffee	16c.
Rice	10c.	Sugar (white)	15c.
Beans	14c.	Cheese	30c.
Panela	10c.	Butter	55c.
Lard	30c.	Onions	25c.
Flour	20c.	Potatoes	30c.
Salt	14c.	Beef	18c.

and the cost is high. Rice comes from the lowlands, and is scarce and costly during April, May, and June. Beans are brought in from Simiti. Coffee, lard, salt, cheese, and tobacco come from the larger river towns. Steers are driven in from the Nechi river to supply beef. The average normal costs at the company stores are shown in Table II.

Duty on imported foods is high, and their final cost is from 200 to 400% above New York wholesale prices. Everything required by the natives must be brought in by the companies, and handled in their stores. Once a community of moderate size has been established, independent merchants will come in and open stores if allowed to do so, when they always charge exorbitant prices, particularly on articles not carried in the company store. On occasions there will be a temporary shortage of an essential commodity in the commissiary. At such times these dealers will reap a harvest. Because of this it is wise for the company to exercise care and supervision in connection with outside stores.

Timber and Buildings

A newcomer to Guamoco will receive the impression that there is an unlimited supply of timber to be had from the jungle-covered hills. Timber is abundant, but of many kinds and grades, and probably 40% of the trees supply a poor quality of wood, no part of which is suitable for lumber, and little will serve as mine timber or firewood. Of the remaining, one-half will furnish ordinary lumber and mine timber, and one-half will provide excellent material, some species being very hard and lasting many years. Trees such as *quimola, canelo, aceite* and *roble* should be used in all heavy and permanent construction.

There are many varieties of palm, and many are useful in housebuilding. Chief among these are the *macana, palmachica* and *rabo-gallo*. The first named has a hollow trunk which, when split in four or five sections, provides suitable strips for making house walls, floors, and beds. The *palma chica* and *rabo-gallo* furnish the best material for thatch roofing.

For the most part, houses for the natives are constructed of poles and *macana* strips, with palm thatch roof. Mother earth does for the floor. For mine, mill, store and office buildings, galvanized-iron roofing is preferable and more economical in the long run. Palm thatch must be renewed every two years, and repaired in the meantime.

In the construction of the more elaborate buildings, such as store, office, and staff living quarters, sawed lumber can be used. Neat and fairly durable walls can be made with poles or *macana* strips, plastered with mud or *adobe*, then whitewashed. All buildings should be designed to provide ample ventilation, as the climate is mild. There are no extremes of heat or cold, and insects are not numerous. There are no flies and few mosquitoes. On account of the heavy rainfall, good roof and ample drainage facilities are necessary. Altitude varies from 3000 to 6000 ft. above sea level, which accounts for the absence of the more trying tropical conditions encountered at lower levels.

Lumber is whipsawed by the natives, and an average cost is $45 per 1000 ft. delivered at the mine. This applies to material in 10- and 12-ft. lengths. Longer pieces will cost more. The sawyers, as a rule, are good workmen, and the material is well turned out.

Mining Methods in the District

Underground work as carried on in Guamoco suggests no comment except, perhaps, as regards crudeness. Owing to the handicap of transportation and the low tonnages handled, no mechanical equipment for this class of work has been brought in. Drilling is all done by hand with the 4-lb. "single jack." Only a few of the natives become what might be termed experts. It appears to be impossible for them to learn to strike an "upper."

The veins are narrow, so no particular timbering problems arise. As a rule the walls are held by stulls; and, when the ground is bad, posts are set on the stulls and pole lagging is placed behind. Some caving for fill has been done, and the usual practice is to drive raises every 25 ft. from adit level to adit level, 100 ft. apart. Intermediate drift levels are also driven. Chutes are built at the bottoms of these raises, then underhand and overhand stoping is carried on until the pocket is exhausted. Cappings 6 or 8 ft. thick are left above and below levels. When a part of the mine is worked out, these cappings are removed. Development work is usually done in the country rock on the foot wall, as better time can be made here than in the hard quartz.

Water has so far caused practically no trouble, the reason for this being that all the mines have been worked by adits and no great amount of sinking has been done below the lowest levels. Should extensive sinking operations be carried on, this would be an important factor.

Daily tonnages are low, and only comparatively high-grade ore can be mined; for under present conditions it does not pay to handle ore containing less than $15 per ton. Production per man-shift for all labor directly connected with mining will average less than one-half ton. This includes a reasonable amount of development work. In the average ground, raises 5 ft. by 6 ft. are driven from 40 to 60 ft. a month; drifts 5 ft. by 6 ft. 6 in. are advanced 35 to 45 ft. in the same length of time. Hard rock may be encountered, and progress is then much slower.

Costs of Operation

A compilation of typical labor costs in normal times is given in Table III. In 1915, total costs per ton of ore treated averaged about $10. That the cost of producing gold in Guamoco has increased considerably can be seen by comparing this amount with the totals in Table IV (general costs in 1917). To the cost per ton in this table should be added about $1 for administration, making the average for the year about $14.51.

TABLE III. LABOR COSTS IN 1915 AT GUAMOCO

	Mine	Mill	Power	Surface	Total	Tons	Per Ton
January	$1948.95	$259.75	$183.20	$449.24	$2841.14	567	$5.01
February	2087.54	233.65	171.35	586.82	3079.36	587	5.24
March	2114.81	276.57	142.06	604.44	3137.88	695	4.52
April	1701.58	244.55	197.55	310.75	2454.43	530	4.63
May	1711.20	287.82	173.40	280.00	2452.42	561	4.39
June	1797.64	261.95	143.75	277.49	2480.83	574	4.32
July	1767.37	267.60	175.20	627.65	2837.82	540	5.25
August	1873.40	270.60	128.52	347.30	2619.82	462	5.67
September	1185.87	338.95	187.32	451.41	2863.55	490	5.84
October	1550.16	358.30	142.20	450.10	2500.76	520	4.80
November	1095.15	294.55	158.60	518.85	2067.15	490	4.21
December	961.56	259.70	190.05	364.75	1776.06	496	3.59
Per ton average	3.039	0.515	0.306	0.809	4.77	...	....

The cost of hauling one ton of freight, in pieces suitable for mule-back transportation, from the coast to central Guamoco, is $160. This sum is apportioned as follows: River boats, $60; canoe, $20; mule-back, $80. Mule-back transportation costs approximately $2 per ton mile, including upkeep of trail and pastures. Natives will contract the hauling only at about the same figure.

Mining and milling supplies are imported under minimum customs duty. Generally speaking, on parcels which can be brought in on the mules, the cost, landed at the mine, is the New York price plus 12c. per lb., gross weight. The costs of blasting materials at the

mines in 1917 were: Powder, $70 per 100 lb.; fuse, $11 per 1000 ft.; caps, $46 per 1000. Local candles, of which three will last a shift, are about 5c. each.

Taxes and Assessments

Taxes and assessments are reasonable. Discovery and denouncement costs are moderate, as is also the annual tax per claim. By paying a certain lump sum, which is not exorbitant, title can be held in perpetuity. An operating company pays a flat annual real estate tax, called the *catastro*, of $100. There is also a monthly importation state tax of $30. Each foreign employee pays a yearly road tax of $10. A butchering tax of $2 per steer killed is charged. In all matters the government officials, who occasionally visit the district, are courteous and obliging, and display no inclination to levy petty graft.

TABLE IV. GENERAL COSTS IN 1917 AT GUAMOCO

	January	February	March	April	May	June	July	August	September	October	November	December
Native labor	$2411.65	$2818.28	$2517.82	$2660.62	$2491.56	$2847.65	$2172.10	$2339.03	$2503.54	$3837.37	$2612.42	$2917.41
Food	812.64	1998.14	1731.47	1084.30	1681.15	1917.29	1803.61	1213.66	1071.74	1125.67	777.37	1211.44
Supplies	1640.99	508.04	3327.29	355.62	1004.10	2132.88	1444.29	1126.77	2521.71	1984.40	1342.86	703.67
Transportation	224.66	939.65	526.56	575.30	460.91	606.73	894.37	510.11	646.23	242.25	332.81	422.45
Commission	57.81	65.33	37.44	108.51	17.09	91.41	71.84	47.15	159.58	39.46	43.59	50.87
Customs duties	17.32	10.09	125.20	166.84	7.97	64.31	27.02	75.67	10.01	.....	129.51	54.29
Taxes	150.00	25.00	85.00	.....	50.50	21.00	128.00	189.00	23.75	52.02	56.06	.....
Exp. sale gold	387.31	501.90	673.90	486.81	503.45	458.31	406.63	435.71	363.60	405.48	622.79	542.52
Miscellaneous	820.00	.....	830.22	458.07	120.70	250.00	255.35	485.23	313.15	319.53	291.65	340.04
Totals	$6522.38	$6866.43	$9827.90	$5896.07	$6337.43	$8389.58	$7203.21	$6422.30	$7623.31	$8006.18	$6209.06	$6242.69
Tons milled	502	473	500	478	512	477	479	500	548	600	610	575
Cost per ton	12.992	14.517	19.655	12.334	12.377	17.588	15.038	12.844	13.911	13.343	10.178	10.856

La Mina Libertad

La Mina Libertad has been and is the most consistent producer of the district. It has been operated for eight years on a series of rich pockets in a quartz vein varying in thickness from 2 to 12 ft. Considerable work had been done on the surface by the Spaniards, and the original equipment consisted of a 500-lb. 5-stamp California-type mill. Water, by means of a Pelton wheel, supplied power direct to the stamps. In 1913 a new mill was built, a 50-h.p. hydro-electric plant installed and five more stamps were added. Later, a Wilfley table was put in and produced high-grade sulphide concentrates. A simple cyanide process is being used to treat these concentrates. The ore is free-milling and the gold amalgamates readily, recovery on the plates being about 90 per cent.

La Mina Chicago

The Chicago Mine furnishes a direct contrast to Libertad, and is the exception of the district, it being the only property operated on base ore. The ore milled is a heavy iron sulphide, with some lead and zinc. No free gold is in evidence, yet the gold content averages from $30 to $40 per ton. Cyanide treatment only is used, the counter-current decantation process being employed. Ore is ground by crusher, Hardinge and pebble mill. Water power is used direct. It is claimed that the best ore has been encountered in the lowest adit, and it is expected that sinking operations will provide ore for some time.

Summary

The foregoing will give the reader an idea of the conditions existing in the hills of Guamoco. Mining operations in Colombia at large are at present hampered by the unsettled commercial relations with other countries. Lack of shipping facilities has curtailed trade with the United States, so that the rate of exchange is very high. At times the American dollar has been worth as low as 79c. in Colombian money. This fact alone has increased the operating costs of American companies considerably. With the resumption of normal trade conditions this handicap will be automatically removed.

That Guamoco will some day be the scene of much more mining activity would seem to be one of the inevitable results of the world's constant search for new sources of gold supply. Many of the untouched quartz veins carry gold valued at $5 and $6 per ton, but present high costs have discouraged development. Although considerable prospecting has been done, there is need of much more, but it is obvious that projects of this nature must be properly financed. The fact that gold has been found so consistently throughout the district would indicate that all the mother pockets have not been uncovered, and the recognized pockety characteristics serve to encourage the belief that some day another Libertad will be found.

Transportation is, of course, the keynote of the problem. Until the mule and canoe are replaced by more rapid and economical agents, possibly the aëroplane, conditions cannot be materially improved. If and when this is brought about, Guamoco will come into its own.

Coal Consumption in Electric Stations

The Hydro-Electric Commission of Ontario recently issued a report entitled "The Rate of Coal Consumption in Various Electro Generating Stations and Industrial Establishments in Canada and the United States." The report emphasizes the influence exerted by plant capacity and plant load factor upon coal consumption, and the data included were obtained from replies received to inquiries made of 73 stations. Half of these were representative stations, ranging in capacity from 150 kw. to 150,000 kw., and most of the figures tabulated are averages for the last five years.

A summation of the data shows the following average rate of coal consumption for various sizes of electric-generating stations using coal-fired boilers.

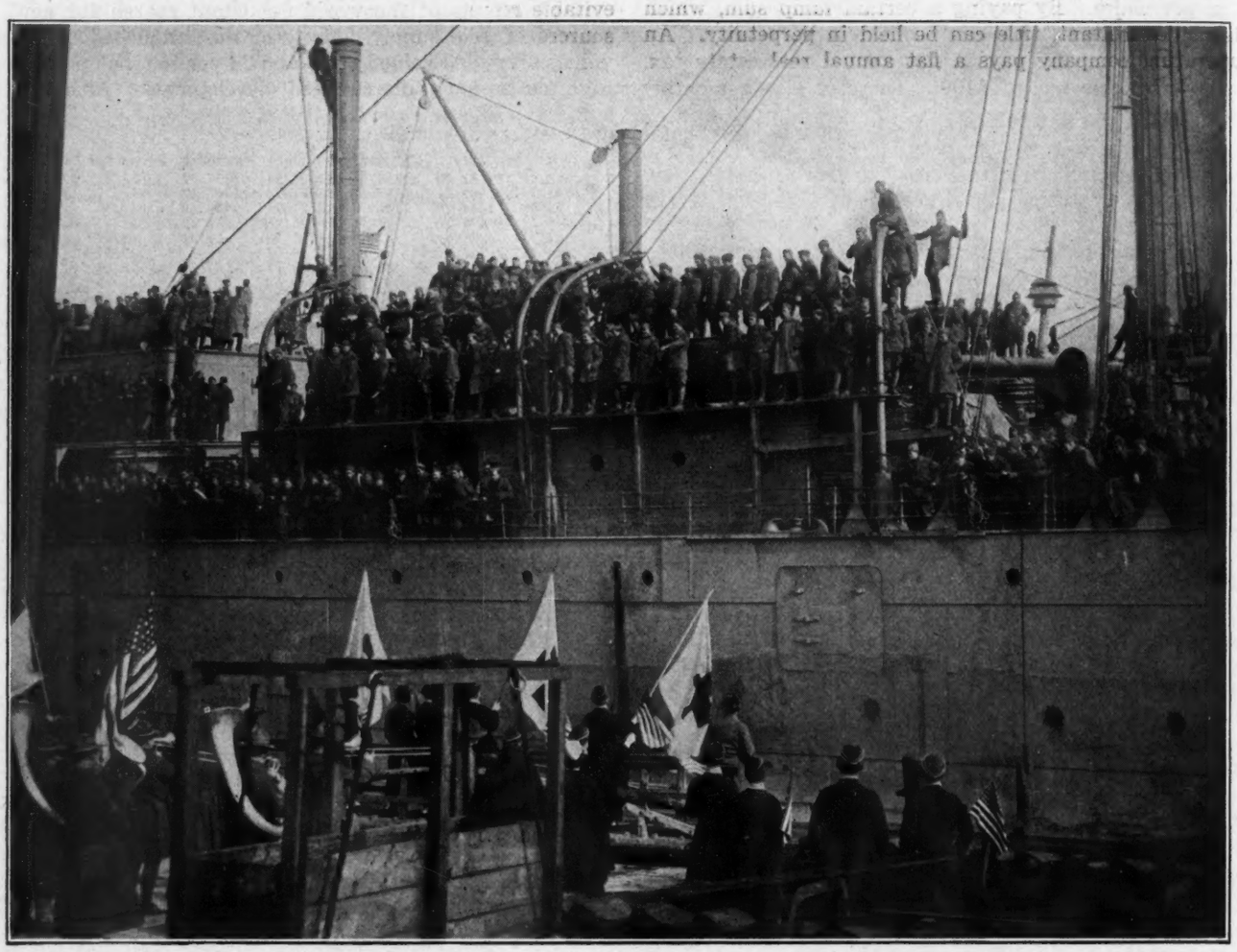
AVERAGE RATES OF COAL CONSUMPTION

(Kilowatts) Station Capacity	Rate of Coal Consumption (Tons per hp.-year)
Below 1,000	25.10
1,000 to 5,000	14.00
5,000 to 10,000	13.30
10,000 to 50,000	9.32
50,000 to 100,000	6.57
Above 100,000	6.25

Under favorable conditions, and in the largest plants, the rate of coal consumption may be as low as 6.25 tons per horsepower-year, but considering average conditions for electric generating stations in Canada, the average rate of coal consumption is not less than 30 tons per horsepower-year.

Thrift Is Shorthand for "Waste not, want not." Buy W. S. S.

The Return of the Mining Regiment



THE "DAKOTAN," CARRYING THE RETURNING 27TH ENGINEERS, DOCKING AT HOBOKEN, NEW JERSEY

COLONEL OSCAR B. PERRY, OF THE 27TH ENGINEERS

PRIVATE WILLIAM H. HALL AND "PUMPKINS"

MAJOR FRED S. NORCROSS

MAJOR R. E. FRANKLIN

The Engineer's Relation to Public Opinion

By SPENCER MILLER*

The following address, the topic of which was the "Engineer as a Citizen," was delivered at the Engineers' Symposium, held on Mar. 26 in the Engineering Societies Building, New York, under the general auspices of the local sections of the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, and the Society of Automotive Engineers. A number of notable addresses were made on related subjects, which have been referred to in recent issues of the "Journal." The tenor of all the speakers' views during the evening was the need of organization to voice engineering opinion on public questions.

PUBLIC opinion is not always right, but it is always autocratic. By a right opinion, I mean one in harmony with the Golden Rule. Public opinion in the United States when Belgium was invaded by Germany was recognized as that of an outraged civilization; but public opinion did not call for immediate armed intervention. There were two opposing opinions in this country—one for war, the other for neutrality. It was not until the late Theodore Roosevelt, Eliot, of Harvard, and other great leaders appealed to our best instincts and awakened our spirits, that public opinion united for war. It was left to President Wilson to translate the awakened spirit of America in his inspiring address before Congress, Apr. 6, 1917. This address expressed America's public opinion and it demanded war with Germany. Who does not remember the thrills we enjoyed when reading that great message? Engineers all over the United States were among the first to declare that our duty resided in aiding France in its heroic fight for life and liberty as freely as Lafayette had aided us, a century and a quarter before.

Public opinion is affected by persistent propaganda, either for good or for evil. The most efficient vehicles to carry propaganda are the public press, the printing press, and the moving pictures.

The engineer is assuming an ever larger position in public life, and in spite of himself he is at the very center of life. The more we realize this great truth, the more seriously do we contemplate our responsibilities. This thought fills some with pride and others with humility. Eliminate the engineer from the world, and civilization would soon pass through other "Dark Ages" comparable with savagery and barbarism.

Even today the engineer stands, with all law-abiding citizens, facing the dark cloud of Bolshevism—not timidly, not indifferently, but in full strength, courage and faith that Bolshevism cannot survive in America. Look at Engineer Hoover, shooting at Bolshevism with bread—excellent ammunition to employ against incipient Bolshevism. The United States will stand firmly against Bolshevism with bullets and bayonets if necessary, because Bolshevism stands squarely against the code of morals upon which our civilization was founded. Is it not clear, therefore, that we individually and collectively should make every possible effort to mold public opinion in the right direction, and, especially at present, to counteract the propaganda of those stirring up class hatred?

Thousands of engineers occupied public posts of responsibility during the Great War, and many of these will be invited to accept larger responsibilities as public servants. To analyze the qualities of the successful engineer in public life we find, in addition to his training as an engineer, a long list of homely virtues: Honesty—Even careful to avoid appearances of gain. Integrity—So clearly evident that none could question it. Unselfishness—Serving the nation for perhaps a fraction of his income in private life. Self-control—Especially of one's temper, frequently sorely tried. Patience and courtesy to thousands of strangers, few of whom can be taken seriously. Willingness to cooperate with others. Courage to stand firm for right against selfish political influence. And, last of all, a spirit willing to renounce all for the good of the nation.

These homely virtues are things of the spirit, and therefore belong to the spiritual part of man. I use the term "spiritual" in its largest sense, and I trust you will not confuse it with "religious." Our greatest and most successful engineers, in and out of public life, are those in whom these homely virtues stand out conspicuously, and are usually referred to as men of "upright character."

The Engineer in Public Life

Thus we observe the engineer is successful in public life because of his *engineer training* and his *upright character*. But who may say that a well-trained lawyer with upright character to his credit would not make an equally good public servant? Is it not evident that both engineer and lawyer are needed in public and political life, and is any comparison advantageous?

A Congress half lawyer and half engineer surely would be superior to one all lawyer or all engineer. Do we not also recognize that experienced business men, manufacturers, and farmers of upright character are also required to serve the nation in Senate and Congress?

What is the relative importance of the training of an engineer as one element and his upright character as the remaining element? Can we look for an answer in the recent struggle in Europe? What is that element which President Wilson sc aptly called "The very stuff of victory"?

The United States declared war in April, 1917. The morale of the French army had reached its lowest ebb, although greatly revived when the French heard of our entrance into the war. Marshal Joffre came to America pleading for *men*, trained or untrained, to support the morale of the French soldier. On the fourth of July, 1917, France was electrified by a parade of a small number of American soldiers through the streets of Paris. The knowledge that America was in the war, that American soldiers were coming fast, was the great sustaining element that prevented the French army from breaking.

The program for the United States involved billions upon billions of money. Ships by the thousands, air-

*Vice-president, American Society of Mechanical Engineers.

planes by the thousands, guns by the hundreds of thousands, rifles by the millions, shells by the millions, tanks in hundred-thousand lots, and several million men besides.

Only a small fraction of these materials of war ever arrived in France, and yet both France and England frankly acknowledged that our troops turned the scales against Germany. What, then, is the answer? Who won the war? What won the war? Surely it was not material things, for the war was going against us with the same amount of material. The answer to the riddle is the same that Napoleon announced one hundred years ago: "The relation of morale to materials of war is as three to one." Morale won the war, and morale is a thing of the spirit. Marshal Foch said only last week that "Faith won the war," and faith is a thing of the spirit.

If the stuff of victory at arms is largely a thing of the spirit, is it not also true of any victory in engineering. Don't you all know that your greatest engineering victories are more traceable to perseverance, industriousness, good habits, courage, pluck, steadfastness, than to simple engineering training as such? Is it not the spirit, after all, that wins all victories?

Morale and a Greatly Simplified Code of Ethics Desired

If the engineer finds that in the complete fulfillment of his life work about one-quarter is material and the remainder spiritual, should not engineering societies make adequate recognition of this important fact? Is not morale as important to the engineer as to the soldier? Is not morale as important to an engineering association as it is to a military division? If these facts are conceded, then can we refuse to give the fullest and most complete consideration to the development of these traits among engineers? Could there be any better beginning than to adopt a thoroughly considered code of ethics to become the moral foundation of all engineering associations, a moral platform that all engineers may stand upon? Several of the societies have codes of ethics now, but codes of ethics, like modern religions, are usually too complicated. We want a simple code of ethics, a standardized code of ethics for engineers and architects.

The Ten Commandments of Moses were really a code of ethics and were inspired in the mountain tops. Our societies might well appoint men whose spirit dwells in mountain tops to come together and compose a code that shall be the Ten Commandments for the engineering profession. When such code has been officially adopted it should appear on the front pages of every year-book, printed in illuminated type. Furthermore, the constitution and bylaws should provide machinery for the enforcement of the code and for punishment for members who violate the code.

Character Should Be Test of Eligibility

This code of ethics should be printed on every application blank for membership in every engineering society, and applicants for membership should accept the code and agree to abide by it before they are taken into membership.

After all, my friends, character stands supreme in the life work of any engineer, and anything which will aid in developing character will not fail in creating a good public opinion.

Flotation Litigation

The flotation patent (No. 835,120) of Minerals Separation Co. reached, for the second time, a hearing before the Supreme Court on Wednesday, Mar. 19, in the Butte & Superior case.

The contention of Minerals Separation counsel was that the defendant company had used the critical amount of pine oil during two years previous to the decision of the Supreme Court which sustained the patent, but that immediately thereafter the company added a sufficient quantity of petroleum oil to bring the total amount of oil used to over 1% for part of the time, and over ½% at other times. The contention of counsel was that the petroleum so added is not an oil of the patent, because it is absolutely inert as a frothing agent, and not only performs no function, but is detrimental. The amount of pine oil was continued at about the same quantity, only a very slight increase being made.

The attorney for the defendant, the Butte & Superior Co., explained to the court that he was in accord with the Supreme Court's finding as to the validity of the patent, and, to assist the court in interpreting its decision, he would recount the evidence which was before the court when it rendered its decision. He quoted fully from the Hyde record, emphasizing the insistence placed at all times upon minute, microscopic or critical quantities of oil. He quoted from the patent that the quantity was from 0.05 to 0.5%, and from witnesses for the plaintiff to the effect that upon all ores the world over and with all oils the limit was between 0.05 and 0.2 per cent.

As to the question of the use of petroleum, he argued that plaintiff's witnesses had testified in many places as to the use of petroleum oils, and that the licensees of Minerals Separation used oil mixtures of absolutely the same composition as that used by the defendant. He quoted from the first written descriptions of the process, in which petroleum was stated by the discoverers as an efficient oil for the process, and, moreover, showed that in the original British patent, of which the patent in suit was the American issue, in every place where oleic acid is mentioned, petrol is also mentioned as an equivalent.

Counsel for the defence contended that the disclaimer which was sent to the Patent Office was, in fact, no disclaimer whatsoever; and that, rather than eliminating the broad features of the three claims which were not sustained by the Supreme Court, the disclaimer actually broadened the claims by language which made the result of the process the limit as to the quantity of oil.

In closing, attorney for the plaintiff again emphasized the claim that petroleum had absolutely no frothing effect on defendant's ore, and was, therefore, not, in that case, an oil of the process, and should not be considered in computing the amount of oil of the process.

Reference was also made to the disclaimer, and the position was taken that the three claims differed from all the other claims of the patent in that they did not relate to a process dependent upon the oil coating of the particles.

Better Than Money, because they earn added money—War Savings Stamps.

Preliminary Report on the Mineral Production Of Canada for 1918

THE preliminary report on the mineral production of Canada for 1918, by John McLeish, chief of the division of Mineral Resources and Statistics, has been issued by the Canadian Department of Mines, Eugene Haanel, director. The total value of the metal and mineral production in 1918 was $210,204,970, the valuation being given as far as possible on the basis of the quantities of the metals recovered in smelteries, and the total quantities in each case are valued at the average market price of the refined metal in a recognized market. During the last three years increased prices of metals and mineral products have contributed toward the increasing of the total value of the mineral production. However, in the report it is stated that out of about 45 items, or products, included in the mineral records, no less than 18 products have reached their highest production in actual quantity during 1918 or 1917. The metal production in 1918 was valued at $113,563,111, an increase of 6.7% over 1917. Cobalt, lead, molybdenum, nickel, silver, and zinc all show increases in production. Gold and silver were less in quantities than in 1917 by small percentages, and in total value gold and copper also showed a decline.

MINERAL PRODUCTION OF CANADA IN 1917 AND 1918

	Quantity	
Metallic:	1917 (a)	1918 (b)
Antimony ore (exports), tons	(c) 361	(c) 26
Cobalt, metallic contained in oxide, etc., lb	1,079,572	1,347,544
Copper, lb	109,227,332	118,415,829
Gold, oz	738,831	710,526
Iron, pig from Canadian ore, tons	46,022	47,444
Iron ore sold for export, tons	169,252	112,886
Lead, lb	32,576,281	43,846,260
Molybdenite, lb	288,705	377,850
Nickel, lb	82,330,280	92,076,034
Platinum, oz	57	39
Silver, oz	22,221,274	21,284,607
Zinc, lb	29,668,764	33,663,690
Non-Metallic:		
Actinolite, tons	120	228
Arsenic, white and arsenic in ore, tons	2,936	3,498
Asbestos, tons	135,502	141,462
Asbestic, tons	18,279	16,734
Chromite, tons	36,725	21,994
Coal, tons	14,046,759	14,979,213
Corundum, tons	188	137
Feldspar, tons	19,462	20,232
Fluorspar, tons	4,249	7,362
Graphite, tons	3,714	3,051
Grindstones, tons	2,523	3,072
Gypsum, tons	336,332	152,287
Magnesite, tons	58,090	58,090
Manganese, tons	158	(d)
Mica, tons	1,166	(d)
Petroleum, bbl	213,832	304,741
Pyrites, tons	416,649	413,698
Quartz, tons	216,288	224,116
Salt, tons	138,909	138,909
Talc, tons	15,803	18,190

(a) Revised figures. (b) Subject to revision. (c) Tons of 2,000 pounds.
(d) Figures not available.

Copper production in 1918 exceeded the high mark of 1916 and was 118,415,829 lb., valued at $29,163,415. Of the total, 92,769,167 lb. was contained in blister copper and in matte produced in Canada, and 25,626,662 lb. estimated as being recovered from ores exported. Quebec production from pyritic ores was 5,869,649 lb., and Ontario production amounted to 47,047,801 lb., derived chiefly from the metal-copper ores of the Sudbury district and the Alexo mine in Temiskaming. Manitoba production was over 2,000,000 lb. and was derived from the ore deposits at Schist Lake. British Columbia produced 62,858,628 lb., and output from the Yukon is estimated at 300,000 pounds.

Total gold production in 1918 was 710,526 oz., and was valued at $14,687,875. Of this production, 16.4% was derived from placer or alluvial mining, 61.8% was in the form of bullion and refined gold, and 21.8% was contained in matte, blister copper, residues, and ores exported. Production by provinces was as follows: Nova Scotia, 1195 oz.; Quebec, 1855 oz.; Ontario, 411,217 oz.; Manitoba, 6755 oz.; British Columbia, 187,069 oz.; and 102,382 oz. was derived from the Yukon Territory. Exports as recorded by the Customs Department were valued at $10,040,813.

The lead production in 1918, estimated at 43,846,260 lb., represents the quantity of refined lead and lead bullion produced in Canada from Canadian ores, together with the lead estimated as recoverable from ores exported. Total mine shipments of lead ores and concentrate were about 76,057 tons, containing 47,673,853 pounds of lead. Exports of lead during the year amounted to 22,684,100 pounds.

Molybdenum production during 1918 was 377,815 lb., and represents the molybdenite contents of the ores and concentrates shipped. Total shipments of ores and concentrates amounted to 430.3 tons, valued by the operators at $428,704. Of this amount, Quebec produced about 88% of the total, the balance being derived from Ontario, including a small production from British Columbia.

Total nickel production was 92,076,034 lb., and was derived from the ores of the Sudbury district. The production of nickel-copper matte at the smelteries of the International Nickel Co. and the Mond Nickel Co. was 86,773 tons. Metal was recovered as a byproduct at the smelteries of the Coniagas Reduction Co., Thorold, Ontario; the Deloro Smelting and Refining Co., Deloro, Ontario, and the Metals Chemical Co., Welland, Ontario.

Production of platinum in 1918 was 39 oz., valued at $2560, and it was all obtained from the placer gravels of the Similkameen district, B. C. Platinum exports in 1918 included: platinum in ore and concentrates, 12 oz., and gold and scrap platinum, 185 ounces.

Canadian silver production in 1918 is estimated at 21,284,607 oz., valued at $20,597,540. Ontario production was 17,109,389 oz., or 80.4% of the total Canadian production. Quebec produced 147,316 oz.; Manitoba, 14,033 oz.; British Columbia, 3,965,828 oz., and the Yukon production was 48,041 ounces.

There was a small production of tungsten from Canadian sources in 1918. Ore received for treatment at the testing laboratory at the Mines Branch, Department of Mines, Ottawa, included about two tons from the Yukon district, four tons from Manitoba, and a small shipment from Nova Scotia.

Production of refined zinc in Canada was 12,278 tons in 1918. Total production of zinc from Canadian ores, including, in addition to the above refined production, the estimated recovery from ores exported, amounted to 33,663,690 lb. Quebec production was 2,652,526 lb., and that of British Columbia was 31,011,164 lb. Total zinc shipments in 1918 were 121,363 tons.

Total iron-ore shipments from Canadian mines in 1918 were 206,820 short tons, and included 8153 tons from Quebec; 197,637 tons from mines in Ontario and about 900 tons mined in British Columbia. Principal

operations were, as usual, in Ontario, at the Holland and Magpie mines of the Algoma Steel Corp., Ltd. Pig iron production during 1918 is estimated at 1,194,000 tons. Production of ferroalloys, including spiegeleisen, ferromolybdenum, and ferrophosphorus, reached a total of 44,700 tons in 1918. Estimated production of steel ingots and direct steel castings was 1,893,000 tons in the year under review.

Asbestos production in Canada was, as usual, derived from the districts in Quebec. The total value of shipments of asbestos and asbestic in 1918 was $8,970,779. The average number of men employed in mining was 1674, in milling 1400, and the total wages paid were $2,871,643. The total shipments of chromite ores and concentrates from Canadian sources during 1918 were 21,994 short tons.

Duties of Engineers as Citizens

The local sections of eighteen engineering societies representing different phases of the engineering profession in Greater New York met on Wednesday evening, Mar. 26, under the chairmanship of Gano Dunn, formerly president of the American Institute of Electrical Engineers, to discuss the relation of the engineer to public activities beyond the limits of his technical horizon. Different angles for discussion were assigned to the five leading speakers. They indicated why engineers should accept civic responsibility and should influence legislation, and how the engineer can be used to advantage in governmental administration.

"We have emerged from the war with a political unrest in which the voice of reason is drowned between the clamor of labor and the sentimental appeal of visionary reformers," said Philip N. Moore, a former president of the American Institute of Mining Engineers, in his address on the "Civic Responsibility of the Engineer." "Now, as never before, we need the trained mind of the engineer to think clearly with unflinching logic from cause to effect."

Calvert Townley, past vice-president of the American Institute of Electrical Engineers, said in the course of his talk on "The Relation of the Engineer to Legislation," that, "An engineering training fits a man to arrive at logical conclusions regardless of outside influences, and he is therefore qualified to express opinions on legislative and other subjects outside his field."

That the trained engineer is the logical man for the management of undertakings involving the planning and execution of engineering, was the conclusion of Nelson P. Lewis, vice-president of the American Society of Civil Engineers, in his paper entitled "The Relation of the Engineer to Administration."

The address of Spencer Miller, vice-president of the American Society of Mechanical Engineers, who spoke on "The Relation of the Engineer to Public Opinion," is given in another part of this issue of the *Journal*.

Comfort A. Adams, president of the American Institute of Electrical Engineers, in his paper on the "Relations of the Engineer to Distribution and Production," pointed out that if engineers could so improve methods and machinery that the productivity of labor would be increased until it is possible to pay labor a real living wage and still have a fair return for capital, then they will have the remedy for the present undercurrent of industrial unrest.

Dr. Doremus S. N. Cassell, Daniel Turner, Frank Skinner, J. G. Johnson, H. A. Pratt, Lieutenant Van Gelder, Farley Osgood, C. F. Scott, J. K. Thompson, Louis C. Marburg, and L. G. Graton were among those who contributed to the discussion.

Foreign Trade in Metals and Ores

Imports and exports of the more important metals and ores, as reported by the Department of Commerce for February, 1919, and the figures for February, 1918, as finally revised, are as follows:

IMPORTS, FEBRUARY, 1918 AND 1919

(In Pounds, Unless Otherwise Stated)

Metal and Ore	Feb., 1918	Feb., 1919
Antimony ore, contents	140,841	3,008
Antimony matte, regulus, or metal	671,675	1,142,280
Copper:		
Ore, contents	10,371,481	5,071,159
Concentrates, contents	3,349,400	3,777,599
Matte, regulus, etc., contents	1,275,562	4,975,442
Imported from (in part):		
Canada	3,080,998	2,705,031
Mexico	3,109,071	5,079,659
Cuba	5,083,201	2,542,393
Chile	3,104,506	1,963,018
Peru	45,289	6,637
Venezuela	2,500	436,907
Unrefined, black, blister, etc	46,638,512	33,369,626
Refined, in bars, plates, etc	763,461	202,375
Old, etc., for remanufacture	82,249	512,866
Composition metal, copper chief value	56	3,701
Lead:		
Ore, contents	2,361,267	520,011
Bullion, contents	7,208,437	13,226,678
Imported from (in part):		
Canada	1,205,828	329,802
Mexico	8,363,876	13,397,628
Pigs, bars, and old	2,479,999	20,755
Pyrites, long tons	55,346	1,053
Imported from:		
Spain, long tons	50,795	.....
Canada, long tons	2,592	1,053
Tin ore, long tons	3,560	1,451
Tin bars, blocks, pigs, etc	7,584,403	6,271,977
Imported from (in part):		
Straits Settlements	2,272,699	6,092,721
Dutch East Indies	615,170	.....
United Kingdom	2,150,959	56,000
Australia	712,582	67,200
Hong Kong	896,566	56,056
Zinc:		
Ore, contents	9,629,293	4,627,863
Imported from:		
Canada	1,092,000	430,166
Mexico	6,239,977	4,197,697
Other Countries	2,297,316	.....
Blocks or pigs, and old	6,141	18
Manganese ore, long tons	56,289	21,819
Imported from (in part):		
Cuba, long tons	209	11,619
Brazil, long tons	51,163	5,450
British India, long tons	2,550	.....
Tungsten ore, long tons	482	1,535

EXPORTS OF COPPER, LEAD AND ZINC

(In Pounds)

	Feb., 1918	Feb., 1919
Copper:		
Ore, contents	151,470	4,200
Concentrates, contents	32,200	.....
Unrefined, black blister, etc	1,431,009	108
Refined, in ingots, bars, etc	59,033,853	30,454,013
Exported to (in part):		
France	28,295,980	2,549,667
Italy	7,288,696	8,426,646
United Kingdom	22,123,748	15,234,685
Canada	1,108,348	629,845
Composition metal, copper chief value	2,884	79,645
Old and scrap	.....	.....
Pipes and tubes	237,030	490,979
Plates and sheets	760,597	3,812,266
Wire, except insulated	1,834,948	5,914,617
Lead:		
Pigs, bars, etc., produced from domestic ore	10,436,237	5,454,105
Pigs, bars, etc., produced from foreign ore	10,200,170	8,260,586
Exported to (in part):		
Denmark	.....	1,015,811
Canada	1,672,016	189,444
United Kingdom	15,859,492	10,089,395
Argentina	456,956	171,102
Japan	1,344,000	.....
France	604,787	1,682,777
Brazil	340,831	243,688
Zinc:		
Dross	1,508,883	4,692,685
Spelter:		
Produced from domestic ore	5,320,616	17,372,468
Produced from foreign ore	1,421,741	4,259,622
Exported to (in part):		
France	1,478,588	12,225,634
Italy	884,800	2,617,620
United Kingdom	3,622,477	5,077,749
Canada	543,918	273,712
Mexico	4,200	422
Japan	.....	1,328,792
Norway	.....	22,409
In sheets, strips, etc	1,130,287	9,320,666

Details of Practical Mining

The Brunton compass has been recognized in mine work as an effective instrument for determining directions, bearings, and similar functions concerning which a fairly accurate knowledge is desired. By means of the method explained, another valuable use is added to the many ways in which the Brunton may be utilized.

The discomfort and danger of wet shaft work and the various operations incident to shaft sinking are subjects of continual study. The method described in "Spitting Fuse in a Wet Shaft" is one solution of the difficulty where water is a menace to blasting.

Utilization of a worn-out washtub for one of the necessary parts of a prospector's outfit, or for the equipment of any mine in the early stages of development, suggests the idea that many cast-off articles may be used in other ways than those for which they were originally intended.

"A Movable Collaring Machine" excludes a crowded condition that may prevail in a small shop. Frequently it is found that such places are cluttered up with all manner of equipment, and this state of affairs will always result in decreased efficiency in the mine operation.

Any engineer who has attempted to get information from frayed or partially obliterated blueprints or maps will welcome the suggestion of any expedient that may assure their preservation in neat and usable condition.

Pocket Transit Sights and Lines

BY C. L. TICE*

A method of using a Brunton pocket transit that is of value in finding the direction or bearing of inclined raises or other workings is depicted in the accompanying photograph. As far as I know it is not only original, but the results can be quickly checked.

By setting the sight as shown, holding the transit reversed, looking through the sight and inclining the mirror with one finger, a position is found which will allow the desired object to be bisected by the line in the mirror by reflection. At the same time the needle and bubble may be easily observed. The photograph shows the observer in the position of taking a sight at a point about 60° above the horizontal. It is also possible by manipulating the mirror to sight a point directly above or even behind the point of observation.

The same method of sighting may be used in setting lines at high or inaccessible points by placing the Brunton on a piece of timber stood upon end, or on one of the telescopic tripods. In this manner it is easy to set a couple of points on any line overhead without waiting for a long plumb line to come to rest. The method is quicker than setting one line, plumbing down to the instrument and then using a plumb line to set the other point. If it is necessary to set lines near iron or steel, which would deflect the needle if sufficiently close, this method will be found useful and can be applied a short distance away regardless of the height of the back.

The accuracy of work done in this manner may be judged by the fact that, to my knowledge, several parallel drifts averaging 75 ft. in length have been driven, after being lined up with a Brunton, with no more variation than could be expected with the use of a magnetic needle. In instances where the drifts have been driven from opposite ends, the point of juncture cannot be distinguished.

METHOD OF USING BRUNTON POCKET TRANSIT IN TAKING INCLINED SIGHTS

In setting lines, the use of No. 7 horseshoe nails, with the heads flattened and notched, will be found convenient. The nails may be driven almost anywhere in the rock in this district, although it is sometimes necessary to hunt for a seam. After a few days the nails will be found to be firmly rusted in place, and they will hold any strain that would be expected of a wooden plug.

*Miami Copper Co., Miami, Arizona.

Spitting Fuse in a Wet Shaft

BY FRANK B. BRYANT*

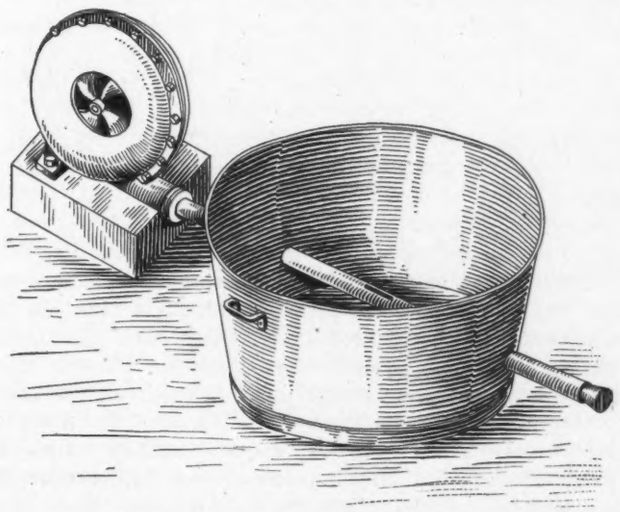
In sinking the Leesburg shaft near Salmon City, Idaho, considerable difficulty was experienced in lighting the fuses for blasting, owing to the water that was encountered. The trouble was overcome in the following manner: A 6-in. length of 2-in. shafting was drawn to a chisel edge at one end, the planes of the bit making

*Mining engineer, Kendall, Montana.

an angle of about 60° with each other. The other end was drilled and tapped to ⅝ in., and a piece of ⅝-in. rod, threaded at one end, was screwed in for a handle. When all was in readiness in the shaft for the shooting, the top man heated the "shooting iron" to a bright red heat at a small forge, and the iron was lowered to the bottom. The water raised in the shaft at about a foot per minute, so that it was necessary to float the fuses with wedges and blocks. One man held the fuses on a small block while the other spit them by stabbing each with the heated iron. No delay was experienced, and two men were able to light as many as 22 holes at one time.

A Prospector's Washtub Forge

A handy forge frame is made out of an old galvanized-iron washtub. A 2-in. pipe, with a slot ¼ x 2 in. cut in the upper side, is placed horizontally, as shown, and connected with the bellows or blower. The other end of the pipe is plugged with a piece of wood. The tub is then filled to the level of the pipe with dirt or ashes, and the rest of the way with coal. If the pipe gets stopped up, the wood plug can be drawn, and the fine coke and ashes blown out. This washtub forge is much more simple for the prospector to put together than one constructed of lumber or rocks, and is fireproof.



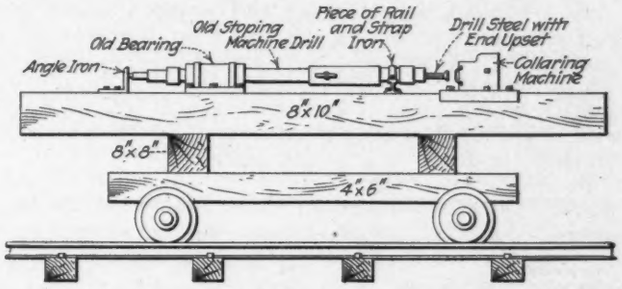
PROSPECTOR'S FORGE MADE FROM WASHTUB

Furthermore, lumber is not always obtainable "forty miles from nowhere." The tub is wide enough to support conveniently the usual lengths of steel used in such work. If long pieces of hand steel are to be sharpened, a bent-rod support is easily attached to the tub. When the prospector moves, the tub is not necessarily an inconvenience, for it can be used as a packing case.

A Movable Collaring Machine

A movable collaring machine which is particularly adapted to the small shop that would be crowded if the machine were mounted in a stationary manner is shown in the accompanying illustration. By means of a single track through the shop, the machine can be moved out of the way when not in use, and so make room on the track for cars to be repaired or for work of similar nature.

The mounting consists of a simple truck, with axles about five feet apart, two cross-pieces of 8 x 8-in. timber or larger, and one 8 x 10-in. timber, 8 or 10 ft. long, placed lengthwise with the truck. To this frame is bolted a small Denver rock drill collaring machine and an old stoping drill. The drill may be held in place by means of an old bearing near the bottom or



DETAIL OF MOVABLE COLLARING MACHINE

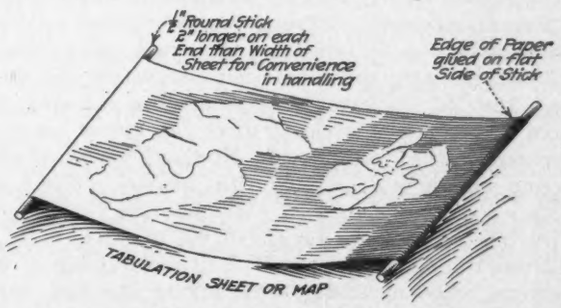
in a similar manner, and a piece of rail or block of iron with an iron strap across the top of it can be placed near the chuck end. A small angle iron bolted to the long timber serves as a brace for the air feed piston to work against.

The holding pieces must be snug to keep the drill from vibrating, but not too tight to prevent the drill from sliding forward when the air is turned on. A short piece of drill steel is placed in the drill chuck with the end upset to strike against the anvil block of the collaring machine. In using this machine, a hammer drill gives much better result than can be secured with a piston machine. By substituting other dollies, bolt heads may be made.

Wooden Edge Protector for Maps

By Roy H. Poston*

Long maps, blueprints, and charts which require handling soon become frayed or torn unless the edges are protected. Frequently only one copy or set is available, and the destruction or obliteration of it would cause much inconvenience. One method of insuring proper


1" Round Stick 2" longer on each End than Width of Sheet for Convenience in handling
Edge of Paper glued on Flat Side of Stick
TABULATION SHEET OR MAP

WOODEN EDGE PROTECTORS FOR LONG MAPS

protection against such possibilities is to glue pieces of half-round wooden stick to the two opposite edges of the print, after the manner shown in the accompanying sketch. This permits the print to be rolled from either end, and thus avoids creases caused by folding, in addition to allowing greater convenience in showing any desired portion of the print.

*St. Francois, Missouri.

Company Reports

Alaska Gastineau Mining Co.

The following summary of results of mining and milling of the Alaska Gastineau Mining Co. for the fourth quarter of the fiscal and calendar year 1918, together with comparisons of the principal items for the previous quarters, is given in a recent report:

OPERATIONS OF ALASKA GASTINEAU MINING CO., 1918

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter	Total
Tons milled	287,571	218,930	309,249	469,695	1,285,445
Gross value of content, per ton	$0.986	$1.323	$1.164	$0.986	$1.089
Yield, per ton	.791	1.093	.954	.79	.883
Tailings, per ton	.195	.230	.210	.196	.206
Extraction, per cent	80.22	82.39	81.96	79.92	81.08
Value of products recovered	$0.79	$1.09	$0.95	$0.78	$0.88
Operating expenses, less miscellaneous income	1.06	1.14	.99	.80	.96
Loss, per ton	$0.27	$0.05	$0.04	$0.02	$0.08

During the fourth quarter, the mine produced about 3126 tons per working day, as against 2400 tons for the third quarter, an increase of 726 tons per day. A total of 173,138 tons of ore was broken in the mine, and 287,875 tons of ore was trammed to the oreways, leaving an estimated total of 1,718,173 tons of broken ore remaining in the stopes, according to the re-survey of broken ore made as of Dec. 31, 1917. A re-survey of the broken ore in the stopes was made at Dec. 31, 1918, and the total figures, not yet completed, will be shown in the annual report. Stoping was continued both east and west on No. 11 level, and the grade of ore broken still remains good and should improve before the stopes reach the No. 10 level. One new stope is being prepared on the No. 10 level and three new stopes are being prepared on the No. 11 level. No development or prospecting work was done during the quarter. The transportation division operated satisfactorily.

During the first two months of the fourth quarter the mill was run on an eight-hour shift per day basis, with overtime when necessary, and during the last month on the basis of two eight-hour shifts per day. The operations were satisfactory throughout the period, although affected by the lack of skilled operators. All the company's generating stations and transmission lines were kept in good conditon, and little trouble was experienced on account of breakdowns. A large amount of rain fell during the latter part of the year, and the two reservoirs are practically full, insuring an ample supply of power for the remainder of the winter and a surplus for sale should the market develop.

The gross value of gold in mill heads for the quarter was $0.986 per ton, as compared with $1.323 for the third quarter, a decrease of $0.337, this decrease being due to the large percentage of ore drawn from the caved stopes. The operating costs amounted to $1.0638, as compared with $1.1480 for the third quarter, a decrease of $0.0842. The "miscellaneous income" account showed a loss of $8226.79, mainly attributable to the operation of the company's boarding houses. The labor supply continued to decrease in October, but for the remainder of the year a considerable number of men applied for work. As most of these applicants were common laborers, the situation was not greatly improved, the urgent demand being for miners, powder men, and skilled mine workers.

The following tabulation shows an operating loss for the quarter of $78,381.20, as compared with the loss of $11,984.13 for the third quarter:

FINANCIAL RESULTS OF OPERATIONS OF ALASKA GASTINEAU MINING CO., 1918

Revenue	Fourth Quarter	Third Quarter	Second Quarter	First Quarter	Total
Gross value of bullion and concentrate produced	$227,541.74	$239,351.98	$294,690.86	$371,044.32	$1,134,523.47
Expenses					
Ore production and transportation	$164,856.28	$125,456.94	$160,692.13	$212,116.73	$663,122.08
Milling	100,662.02	87,264.82	106,158.51	126,336.16	420,421.51
Shipping and smelting charges	10,460.73	11,098.12	12,594.65	14,217.97	45,539.15
Administration and general expenses	21,717.12	25,309.24	23,828.24	22,714.09	92,954.25
Total operating expense	$297,696.15	$249,129.12	$303,273.53	$375,384.95	$1,225,036.99
	$70,154.41	$9,777.14	$8,582.67	$4,340.63	$90,513.52
Miscellaneous income	8,226.79(a)	2,206.99(a)	5,665.29(a)	3,677.64(a)	19,776.71 (a)
Operating loss	$78,381.20	$11,984.13	$14,247.96	$8,018.27	$110,290.23(b)

(a) Loss. (b) The total column includes adjustments of published quarterly figures.

St. Joseph Lead Co.

The annual report of the St. Joseph Lead Co., covering the year 1918, shows that dividends amounting to $2,818,992 were disbursed during the period. The company's mills and concentrators produced 133,099 tons of lead concentrate, 125,320 tons of which was shipped to the company's smeltery and 7779 tons was sold to other concerns. The mines produced 2,299,490 tons of ore, and the total smelting output was 79,620 tons of pig lead.

With the signing of the armistice in November and the subsequent cancellation of Government munition contracts, the purchase of nearly 25,000 tons of lead per month which had been going into direct or indirect Government war uses was discontinued in the month of December; so that from the position of being entirely unable to meet the demand, the lead industry faced the prospect of a serious over-supply. No one expected that the full 25,000 tons a month could quickly be diverted to peace uses, this amount representing more than half the normal production. Most of the companies saw the necessity of at once curtailing output, but none of them desired to make the curtailment sufficiently drastic to throw out of employment large numbers of their employees at the beginning of the winter. The companies in St. Francois County, Mo., where the St. Joseph Lead Co.'s mines are situated, in early December went to a five-day week; but as lead continued to pile up, a still further cut in production was made. The company is now operating at about 60% of normal.

Portland Gold Mining Co.

The president of the Portland Gold Mining Co., Frank G. Peck, in the 25th annual report of the company says:

The Colorado Springs mill ceased operations on Mar. 31, 1918, so far as the treatment of ores was concerned. The production of high-grade ores in the Cripple Creek district had fallen off to such an extent by reason of war conditions that it was impossible to operate at a profit both of the reduction plants in Colorado Springs; and, our mill being the smaller of the two, it was decided to discontinue its operation, and to have our high-grade ores treated at the Golden Cycle plant, under a temporary and fairly satisfactory arrangement made at that time. If there should be a material increase in the output of the Cripple Creek district, or if changed conditions should later make it desirable to discontinue the present arrangement, we can either resume operations at our Colorado Springs plant, or treat these ores at our Independence mill, as may be deemed most advisable.

Important experimental work was carried on at our Colorado Springs plant during the last nine months of the year, by representatives of the U. S. Government, in an endeavor to develop a process for extracting potash from our tailings dumps. It has been discovered that these tailings contain 7% of potash, or about 140 pounds to the ton. There are about two million tons of tailings in the Colorado Springs mill dumps, and important progress was made toward devising a method of extraction.

The Victor mill was closed on July 30, 1918, on account of the impossibility of securing labor sufficient to supply the tonnage of low-grade ore necessary for economical operation of both it and the Independence mill. Much of the machinery from the Victor mill has already been moved to the Independence plant, and eventually all of it will be transferred, thus carrying out a part of the plan decided upon by the board several years ago, of ultimately combining all ore-reduction operations at the Independence plant. The Independence mill treated a considerable tonnage of low-grade ore during the year, and although the percentage of extraction was good, the profits realized were disappointing, largely owing to war conditions. Almost without exception, every improvement devised to reduce costs, and every economy instituted during the year, was immediately offset by some increase in the cost of labor, or of some chemical or commodity entering into the extraction of gold. However, now that the war is over, the trend of costs undoubtedly will be in the other direction. In other words, the purchasing power of gold, instead of decreasing, as during the last two or three years, should slowly increase, and the plant should earn a good profit during the coming year.

The most important event during 1918 was the completion of a branch tunnel from the Roosevelt drainage tunnel to a connection with Portland shaft No. 2 at a depth of 2131 ft. from the surface. The main drainage tunnel, work on which was begun 11 years ago, is 24,255 ft. long from its portal to its heading, which is about the middle of the northerly portion of the company's property.

On Dec. 29 our main shaft was sunk to the 21st or drainage-tunnel level. The work of timbering the shaft and cutting out a station of sufficient size to install pumps and to allow room for the work of opening up the high-grade orebodies there will soon be accomplished. We will then begin driving on our No. 1 vein, which contains the largest and best orebody we have. This will enable us to materially increase our high-grade production. Our Lee No. 5 orebody was cut by the drainage tunnel crosscut.

At the beginning of 1918 we had a good cash balance in our treasury, but the excessive cost of supplies, the heavy draft on our skilled labor by the Government, and the shortage of experienced miners, which compelled us to fill our vacancies with unskilled men, increased our operating expense so much that we carefully considered the situation thus brought about and acted accordingly. In July, on account of the small profits earned during the first half of 1918, we reduced our quarterly dividend from 3c. to 2c. per share, as it was evident that a considerable part of our dividend for the year would have to be paid out of our accumulated surplus earnings.

Taking everything into consideration, the outlook for the future is promising. The profits from our Independence mill should be sufficient to pay dividends at the present rate during the coming year. The labor situation is improving, and if the orebodies on the 21st level and below it, which are made accessible by the branch tunnel, prove to be measurably near to the production that we anticipate, the net earnings from the mine for the year should be sufficient to build up the treasury cash balance to satisfactory dimensions.

Much to our regret, F. L. Smale, the manager of the mining department, severed his connection with the company last October, after many years of valuable service. After Mr. Smale's resignation, we decided to place the mining and the milling departments under one head, and George M. Taylor was put in charge of both departments as general manager of the company. This arrangement has proved satisfactory, and great credit is due Mr. Taylor and his assistants, Fred Jones, superintendent of the mine; Thomas B. Crowe, superintendent of the mill; and Luther Lennox, assistant superintendent of the mill, for the success that has followed from the consolidation of the two departments under one head. The financial report shows that the gross value of ore mined and shipped during 1918 was $1,120,851.25, products recovered by the Victor mill realized $942,791.77, and revenue from all other sources, $14,066.31. The net cost of mining and milling was $1,881,113.10, leaving a net profit from operation of mines and mills of $196,596.23. Dividends were paid during the period amounting to $300,000, making a total of dividends paid to Jan. 1, 1919, of $11,257,080.

Rambler-Cariboo Mines, Ltd.

The Rambler-Cariboo Mines, Ltd., reports that for the eight months ended Dec. 31, 1918, 5400 tons of material was mined and milled, producing 400 tons of lead concentrates and 310 tons of zinc concentrates. The concentrator was in operation six months, the remaining time being spent in repairs made necessary by snowslides during the spring. Owing to high costs and scarcity of labor, little development work was done. No shipments of crude lead were made.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

War-Minerals Relief Commission

The regulations governing the filing of claims under the War-Minerals Relief Act have been amended so as to allow claimants to file a brief with the questionnaire. It has been decided that hearings will be conducted by the War-Minerals Relief Commission when good reason for such action can be shown. When justified, the commission will conduct the hearing at a point easy of access from the mining district concerned.

Applications for relief are beginning to reach the commission in considerable volume. Thirty claims have been presented in such a condition that they have been formally filed with the commission. Many others have been returned with instructions as to the precise information required and the precedure to be followed. In addition, a large number of inquiries have been received. The following clauses have been added to the questionnaire:

Attach copies of all contracts: (1) For the financing of the enterprise; (2) by which money was raised; (3) for the sales of the minerals produced. Give name and amount of stock owned by each stockholder holding more than 5% of the stock of the company. Did the high price of the minerals influence claimant in determining to make production? At the time claimant determined to produce any of said minerals, did claimant contemplate presenting a claim against the Government in case losses were incurred? If so, did claimant inform any of said Government agencies or their officers, agents, or employees of that intention? Did claimant consult with any of said Government agencies or their officers, agents, or employees as to the machinery to be bought, the land to be leased or purchased, or the buildings to be constructed? Did claimant pay to any employees any damages for personal injuries sustained in the work of producing any of said minerals?

A determined effort was made to induce the Secretary of the Interior to open a Pacific Coast branch office of the War-Minerals Relief Commission. Secretary Lane, however, declined to do so, as he regarded it as impracticable to divide the work.

Sale of Surplus Motor Vehicles

Many rumors have been circulated as to the disposition of the surplus motor-driven vehicles now owned by the War Department. The following outline of the proposed method of handling this matter is given by the Director of Sales, War Department:

1. The different branches of the Government will be consulted to see whether the surplus of automobiles and motor trucks in the War Department can be used to fill their requirements.

2. Various manufacturers of vehicles will then be approached to see if they will take over the vehicles of their own make to market them with their own machines, thus giving the Government a fair market price and at the same time disturbing the market conditions as little as possible.

3. The net surplus remaining after the above methods have been adopted will be disposed of to the public, either through auction or by sealed bids. Full publicity will be given these sales, in order that the Government may realize the best results.

Reducing Clay and Gypsum Prices

Producers of gypsum and clay have held preliminary conferences with the Industrial Board with regard to a further reduction in prices. No conclusion has been attained, but it is believed that an agreement providing for slight reductions will be reached. J. E. Spurr, of the Bureau of Mines, is the member of the Industrial Board Advisory Committee, and he will act in an advisory capacity on mineral matters.

Economic Liaison Commission

An economic liaison commission has been formed by the State Department. It is made up of representatives from the departments in which the work has a bearing on foreign trade. The mining industry is represented by E. S. Bastin, of the Geological Survey, and H. C. Morris, of the Bureau of Mines. They will advise on problems relating to the minerals both with regard to import and export. The committee will meet every week. It is under the direction of Julius G. Lay, the foreign-trade adviser of the State Department. Members of the committee, other than those mentioned, are: Wesley Frost, Economic Intelligence Section, State Department; Karl Delaittre, Bureau of Research, War Trade Board; Col. John M. Dunn, General Staff; C. E. McGuire, Treasury Department; Roland D. Mahoney, Labor Department; Clarence W. Moomaw, Department of Agriculture; William Notz, Federal Trade Commission; Commander F. F. Rogers, Navy Department; W. M. Steuart, Tariff Commission; Walter S. Tower, Shipping Board.

Preparations are being made by the War Department to conduct research work on nitrates at the American University, near Washington. This is being done to take advantage of the equipment and facilities which are being abandoned by the Chemical Warfare Service.

C. B. Holmes has been retained as chief accountant for the War-Minerals Relief Commission. For many years Mr. Holmes was in the employ of the Chile Exploration Co., the Braden Copper Co., and other Guggenheim concerns.

Questionable stock promotion schemes are to receive the active attention of the Federal Trade Commission. Searching questionnaires have been sent out to a large number of companies and individuals now engaged in the sale of stocks, with the purpose of securing more complete information as to the extent and nature of their operations.

27th Engineers' Fund Is Still Growing

In the *Journal* of Mar. 29 it was announced that the fund of the Association of the 27th Engineers had reached its goal of $20,000. Since then additional contributions and receipts have been as follows:

H. C. Hyer	$25.00
Oscar Lachmund and Van H. Smith	20.00
Christmas donations from employees of Braden Copper Co. at Rancagua, Chile	450.00
Interest on bank deposit	14.73
Total	$20,509.73

The association is going to publish a memoir, giving a history of the 27th Engineers, a complete roster of the officers and men, and all other details of interest. A copy will be sent to each member of the regiment and to each subscriber to the fund.

Members of the regiment will receive also a bronze medal made according to a design which was adopted by the regiment while in France. If any of the men have a different address from the one on the roster, they should notify W. R. Ingalls, secretary-treasurer of the Association of the 27th Engineers.

Sale of Ordnance Scrap

WASHINGTON CORRESPONDENCE

Ordnance scrap is being placed on the market at current prices, and is being taken rapidly. It is predicted that all of the existing stocks will be disposed of within two months. Stocks as of Feb. 28, the last figures available, were as follows:

	Pounds
Brass scrap, all kinds	5,162,405
Cupro nickel, all kinds	700,540
Aluminum scrap, all kinds	62,893
Copper scrap, all kinds	1,219,218
Machine shop borings and turnings	4,640,989
Heavy melting steel scrap	1,685,097
Low-phosphorus steel scrap	6,838,539
Nickel-steel borings and turnings	2,887,779
Nickel-steel scrap (heavy)	5,692,345
Cast and malleable iron scrap	1,042,097
High-speed steel scrap, borings and turnings	148,453
Babbitt	228,428
Mixed and miscellaneous iron and steel scrap	1,119,260
Brass sweepings, ashes, etc.	265,119
Lead scrap, all kinds	94,005
Chemicals, acids, etc.	3,594,795
Miscellaneous scrap (rags, paper, wood, etc.)	535,949
Burlap	33,098
Total	35,948,009

Compensation to War-Mineral Producers

WASHINGTON CORRESPONDENCE

The conditions governing the presentation of claims for loss incurred in the production and exploitation of manganese, chrome, tungsten, and pyrite ores are as follows:

1. All claims must be in writing, contain a statement of the facts upon which losses are based, subscribed and sworn to before a notary public or clerk of a court of record.

2. All claims must be filed in the office of the Secretary of the Interior, Washington, D. C., within three (3) months from and after the approval of said act, i.e., on or before June 2, 1919.

3. Claims for losses cannot be considered which relate to any other minerals.

4. There can be adjusted, liquidated and paid only such net losses as have been suffered by any person, firm, or corporation by reason of producing, or preparing to produce, any of said minerals in compliance with the request or demand of the Department of the Interior, the War Industries Board, the War Trade Board, the Shipping Board or the Emergency Fleet Corporation to supply the urgent needs of the nation in the prosecution of the war.

5. No claim can be allowed unless the expenditures made or obligations incurred were subsequent to Apr. 6, 1917, and prior to Nov. 12, 1918, in a legitimate attempt to produce any of said minerals for the needs of the nation for the prosecution of the war.

6. No profits of any kind shall be included in any claim, and no investment for merely speculative purposes will be recognized.

A questionnaire to be executed under oath by the claimant, or claimants, setting out the facts on which the claim is based, is inclosed herewith. This questionnaire must be returned to the War-Minerals Relief Commission, Room 2131, Interior Department Building, Washington, D. C.

Bituminous Coal Output Falls

WASHINGTON CORRESPONDENCE

Less bituminous coal was mined during the week ended Mar. 22 than during any week since Christmas, the amount being 7,477,000 tons, according to estimates furnished to the U. S. Fuel Administration by the Geological Survey.

Last year the output recorded for the corresponding week was 11,121,000 tons, or nearly 50% more. The chief cause of the drop was lack of orders, and time was lost on St. Patrick's Day.

The loss from full-time production because of "no market" during the week ended Mar. 15 was 42.8%, compared with 41.8, 41.9, and 43.0%, respectively, for the three weeks next preceding. Total losses from full time during the week ended Mar. 15 amounted to 48.0 per cent.

Anthracite production during the week ended Mar. 22 is estimated at 1,171,000 tons, as against 1,206,000 tons the previous week, and 2,099,000 net tons for the corresponding week of last year.

Molybdenum in the British Empire*

According to Sydney J. Johnston, of the Scientific and Technical Department, Imperial Institute, although molybdenum minerals are fairly widely distributed throughout the British Empire, deposits of proved commercial importance are few. The largest producers in the past have been Queensland (111 tons in 1917), and New South Wales (70 tons in 1917), but the United States, Canada (121 tons in 1917), and Norway are now rapidly becoming important contributors to the world's supply. India has produced only 1.7 tons, in 1917. Low-grade orebodies carrying molybdenite are of fairly common occurrence, but high-grade deposits such as were almost exclusively worked before the war are somewhat rare. About three-quarters of the world's output of molybdenum ore has been won from tungsten and bismuth deposits, and a smaller quantity has been obtained as a byproduct in the mining of tin.

Sales of metals by the War Department from Mar. 15 to Mar. 21 are reported as follows: Non-ferrous, $425,966.75; ferrous, $48,015.60.

*Abstracted from *Iron and Coal Trade Review*, Jan. 3, 1919, p. 22.

March Mining Dividends

Dividends paid in March, 1919, by 28 United States mining and metallurgical companies making public reports amounted to $12,050,438, as compared with $27,240,511 paid by 35 companies in March, 1918. Holding companies paid $366,572, as compared with $413,433 in 1917. Canadian, Mexican and South American mining companies paid $1,464,840 in March, 1919, and $1,806,213 in March, 1918.

United States Mining and Metallurgical

Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	$1.00	$200,000
Allouez, c	Mich.	1.00	100,000
Am. Sm. and Ref., com	U. S.-Mex.	1.00	609,980
Am. Sm. and Ref., pfd	U. S.-Mex.	1.75	875,000
Argonaut, g	Calif.	.05	10,000
Arizona Cop	Ariz.	.36	554,000
Bingham Mines, c	Utah	.25	37,500
Caledonia, l. s	Ida.	.01	26,050
Calumet & Ariz., c	Ariz.	1.00	642,480
Chino, c	N. M.	.75	652,485
Copper Range, c	Mich.	1.00	395,000
Cresson Cons., g	Colo.	.10	122,000
Eagle & Blue Bell, l.s	Utah	.05	44,658
Federal Min. & Sm., pfd	U. S.	1.75	209,757
Golden Cycle, g	Colo.	.03	45,000
Hecla, l.s	Ida.	.15	150,000
Homestake, g	S. D.	.50	125,580
Internat. Nickel	U. S.-Can.	.50	836,692
Isle Royale, c	Mich.	.50	75,000
Kennecott, c	....	.50	1,393,477
Nevada Con., c	Nev.	.37½	749,797
Oroville Dredg	Calif.	.12	82,385
Osceola, c	Mich.	1.00	96,150
Quincy, c	Mich.	1.00	110,000
Ray Con., c	Ariz.	.50	788,589
St. Joseph Lead	Mo.	.35	493,313
Tintic Standard, l.c	Utah	.08	93,400
United Eastern, g	Ariz.	.07	95,410
Utah Copper	Utah	1.50	2,436,735

Canadian, South American and Mexican

Companies	Situation	Per Share	Total
Cerro de Pasco, c	So. Am.	$1.00	$898,224
Florence Silver, s.l	B. C.	.01½	17,650
Hedley, g	B. C.	.10	24,000
Kerr Lake, s	Ont.	.25	150,000
Mexico Mines of El Oro, g.s	Mex.	.96	174,960
Min. Corpn. of Can., s	Ont.	.12½	200,006
Holding Companies	**Situation**	**Per Share**	**Total**
Calif. Explor	Calif.	$0.12	$28,139
Exploration Co	Mex.	.18	135,000
Yukon Alaska Trust	.....	1.00	203,433

Total dividends in the first three months of the year were as follows, the 1918 figures being given in parentheses: United States mining and metallurgical companies, $29,434,006 ($47,261,524); holding companies, $696,572 ($743,433); Canadian, Mexican, Central and South American companies, $4,614,412 ($4,627,775).

The dividend record of March, 1919, was largely one of reductions, most of the companies finding it necessary to curtail. Three companies, Calumet & Hecla, Old Dominion, and Utah Consolidated, passed their regular payments. In the case of the copper companies, the reason, no doubt, was the unsettled condition of the market. Of thirteen copper companies, including the American Smelting and Refining Co., seven reduced their dividends by one-half, four by one-third, and two by one-quarter.

Metallurgists and Engineers Needed

The United States Civil Service Commission, Washington, D. C., makes announcement that open competitive civil-service examinations are to be held on Apr. 15, 1919, for junior metallurgists, at entrance salaries of $1500 a year, and junior mining engineers, at entrance salaries of $1200 to $1500 a year; and on May 6, 1919, for mining engineers for metal and mineral mining investigations, at entrance salaries of $3000 to $4000 a year for Grade 3, $2400 to $3000 a year for Grade 2, and $1800 to $2400 a year for Grade 1. Full information may be obtained from the commission.

Mining Convention at Vancouver

To plan the extensive development of the latent mineral resources of the Pacific Northwest; to face the problems of the present with enterprise and courage; and, above all, to display that confidence in the country's wealth which well-substantiated facts warrant—these were some of the general points made by prominent Western mining men who took part in the International Mining Convention held at Vancouver, B. C., from Mar. 17 to 19, inclusive. Between 500 and 600 delegates were in attendance, the greater part of whom were visitors. All the Pacific Coast states, British Columbia's various mineral districts, the Yukon Territory, and Alaska were represented. Vancouver threw open her doors wide, and for the week the city belonged to the mining men, who were warmly welcomed and hospitably entertained.

The British Columbia Chamber of Mines, of Vancouver, B. C., under whose auspices the convention was conducted, is to be congratulated alike on the personnel of the gathering, the educational features of its program, and the thorough preparations made for the entertainment of the guests. A full account of the convention will be given in a subsequent issue.

The Mining Industry in Utah

A committee to represent the operators of mines, mills and smelteries in the State of Utah has been formed to investigate the conditions prevailing there. It consists of Imer Pett, general manager, Bingham Mines Co., and Eagle & Blue Bell Mining Co., chairman; C. E. Allen, manager of mines, U. S. Smelting, Refining and Mining Co., vice-president; Fred Gowans, general manager, Utah Consolidated Mining Co.; C. F. Jennings, assistant purchasing agent, Utah Copper Co.; F. J. Westcott, secretary, Silver King Coalition Mines Co., and J. B. Whitehill, ore purchasing agent, International Smelting Company.

A statement has been issued which draws attention to the fact that the situation is so serious that relief must come in the immediate future if metal mining operations are to continue. When the armistice was signed on Nov. 11, 1918, copper was selling at 26c. per lb., and lead at $8.05 per 100 lb. Almost immediately afterward the market for these metals practically disappeared, and in the case of copper there were no quotations until February, 1919. Copper is now quoted at about 15c., with few buyers, and lead is in limited demand around $5.25. There is no reason to anticipate any substantial advances in the prices of these metals for at least a year to come.

The greatly decreased prices for metals threw a heavy burden on the mining companies of the state. Smaller producers have been compelled to suspend work entirely, and the larger producers have reduced operations materially. The Salt Lake valley smelters have curtailed their operations fully 50%. The mining companies have met the situation in part by reducing wages from the high point reached during the war. Reductions have amounted to from 75c. to $1 per day. To compare with the average wage reduction, the cost of necessaries of life must be reduced about 20 per cent.

The mining companies hoped and expected that they and their employees would not be left to bear the burden alone, and that there would be corresponding reductions in the cost of supplies for the mines and the

necessaries of life. Such, however, has not been the case. Almost without exception, supplies have continued at the war-time price levels, and necessaries of life cost as much as or more than they did in July, 1918. The committee purposes to ascertain whether this condition is due to the attitude of manufacturer, wholesaler, or retailer.

The mining industry has borne all the burden it can. Others interested must assume a part of the load unless they are prepared to sacrifice a considerable proportion of the benefits they have derived through mining activity, and from the patronage of those who have gained their livelihood in the state.

Fight It Out for Yourself

In several respects all Americans have gained by the war. They have gained those things for which their boys died, or at least they can feel that those things are now in sight. Some feel that they have lost more than was gained and doubt if it was all worth the price. Thank God that number is small. For the sake of those who fell and were glad to pay that price, let everyone cherish the country's gains and try to forget individual losses which were so much less than the sacrifices of the men who gave their lives.

Their debts have all been paid, their slates are clean. The obligations of those that are left are not canceled. The slacker may say that the war is over and that patriotism is not going to draw any more Liberty Loan money out of his pocket, but it is the duty of the patriotic man and woman to consider what ought to be their attitude in respect to the next Liberty Loan, and to argue the matter out with their own consciences. It is safe to say that both they and Uncle Sam will be pleased with the result of that argument.

The Yerington District of Nevada

The Yerington, or Mason Valley, district, in western Nevada, is, next to Ely, the most productive copper district in the state. Before 1912 it had not produced much copper, but from 1912 to the end of 1918 it produced 80,000,000 lb. The ore deposits of the district are described in detail in a report recently issued by the U. S. Geological Survey, as Professional Paper 114.

Mining began in the Yerington district at least as early as 1865, when attempts were made, at the Ludwig mine, to work bodies of oxidized copper ore. Before 1907, however, mining in the district was intermittent and the mineral output was small. The most important of the early operations was the mining of natural bluestone, which occurred in the outcrops of the chief orebodies of the Yerington district and many thousand tons of which were mined to furnish the copper sulphate used in the mills at Virginia City in the Washoe process. In those early days a smeltery was built at Ludwig, but it was not successful. A smeltery was built also at the Bluestone mine, on the east side of the range, but it was not operated long; and another built at Yerington station made no considerable output. These early attempts were directed chiefly to mining the oxidized ores, which were naturally richer, though far less abundant, than the sulphide ore. In the absence of transportation facilities, the larger bodies of primary ore, nearly all of which are of low grade, were not commercially attractive.

Interest in the district revived about 1907. Some of the largest deposits were bought by energetic companies having adequate capital, and active exploration and development were begun. The Nevada Copper Belt R.R., begun in August, 1909, and completed to Ludwig in September, 1911, was built into the district from Wabuska, on the Southern Pacific system. A smelting plant, eventually increased to a capacity of 1800 tons a day, was constructed by the Mason Valley Mines Co. at Thompson, two miles north of Wabuska. It began operations on Jan. 6, 1912, and soon made a considerable output, largely from the ore deposits of the Yerington district.

The copper deposits of the district consist of chalcopyrite and pyrites, intergrown with pyroxene, garnet, and epidote. They are of the contact-metamorphic type, and their geologic features are of much scientific interest. The investigation of the origin of the ore deposits has led to certain practical recommendations as to the most systematic and effective way in which to explore for undiscovered ore.

Ceylon Plumbago in 1918

Decreased shipments of graphite to the United States in 1918 adversely affected the Ceylon plumbago industry, according to Consul Walter A. Leonard in *Commerce Reports*. In 1916 the United States took 75% of Ceylon's plumbago and in 1917 over 81%, whereas in 1918 America took barely 55% (percentage based on quantity, not value). Before the total prohibition of import was put into effect, on July 1, 1918, American shipments were below normal. According to invoices certified at this consulate, only 7910 tons, valued at $1,374,221, was shipped to the United States in 1918, as compared with 22,121 tons, valued at $6,550,302, in 1917.

Exports of Ceylon plumbago in 1918 were considerably less than in any previous year during the past 10-year period, except in 1914, when 14,300 long tons was exported, as compared with 15,500 tons in 1918. In the record year of 1916 exports totaled over 33,000 tons, compared with approximately 27,000 tons in 1917. The years 1909, 1910, 1912, and 1913 showed exports greater than those in 1917 and nearly equal to the figures of 1916, although the value of the exports during these earlier years was less.

The distribution of plumbago exports covering the years 1917 and 1918, respectively, as compiled by the Ceylon Chamber of Commerce, is given in the following table:

DISTRIBUTION OF EXPORTS OF CEYLON PLUMBAGO, 1917 AND 1918

Countries	1917 Tons	1918 Tons	Countries	1917 Tons	1918 Tons
America.....	21,965	8,409	Japan.....	.....	61
United Kingdom.....	4,600	6,386	Russia.....	100	.....
India.....	145	303	Totals....	27,047	15,453
Australia.....	237	294			

It is reported that the high prices of Ceylon plumbago in 1916 and early 1917 made it possible for competition from Madagascar and other graphite fields to react against the Ceylon market. It is not expected that such high prices will rule again in Ceylon. Lump plumbago is now quoted at $115 to $225 per long ton, as compared with prices ranging as high as $500 in late 1916 and early 1917. Prices of other grades of plumbago are at present comparatively low, chips ranging from $65 to $150, dust from $20 to $100, and flying dust as low as $13 per ton.

Editorials

The Task Ahead for America

THE task of winning Prosperity is, if anything, greater than was the task of winning Liberty.

It can be won only by our uniting to solve the problems of Peace as we united to solve those of War; by continuing, each one of us, to do his or her individual, personal share.

The war expenditures of the Government were not cut short by the signing of the armistice; the immense machinery of warfare could not be wiped out in a day.

We still have an unpaid balance of several billion dollars of war debts. We still have a huge army overseas that must be fed, supplied, paid, and brought back home. Our disabled soldiers and sailors must be tenderly cared for. Great hospitals and demobilization camps must be maintained.

In a multitude of unavoidable ways the country is still under an enormous war expenditure.

We have got to *finish the job.*

The Engineer in Public Life

THE calling of an important meeting of a number of engineering societies, for the purpose of discussing the subject of engineers and their obligations in the matter of personal service in public affairs, is a forceful reminder of the fact that the profession has not, to date, contributed its share to the public welfare in this respect. Members of the legal and medical professions continue to influence legislation and public opinion, but engineers appear to lack the required initiative, and timidly remain in the background when experienced advice is much needed, and which, if given freely, would redound to their own good and to the credit of the profession.

The discovery of Hoover was due to the fact that he, and he alone among all the American officials in London at the outbreak of the Great War, had the training and experience to see that the delicate and difficult situations involved in the handling of thousands of dazed and penniless refugees in the English metropolis must be by calm, common-sense engineering methods. And the first step he took was to divide the 24-hour day into three engineering shifts of eight hours apiece.

It was Hoover's experience with men, gained as an engineer in all parts of the world, that enabled him to classify the applicants for relief into "good," "bad," and "indifferent," and with such skill that practically all the money that was loaned was ultimately returned. It was Hoover's practical engineering talent in such elementary though vital matters that resulted in the successful solution of a difficult problem, and led to his translation to other and more important spheres of action; and it is worthy of note that all the undertakings with which his name has been associated have been managed without that chaos and evidence of frantic disorganization that so often hide the inefficiency of speed cranks and diagram-chart experts.

The basis of efficiency is sound engineering common sense. It is to be hoped that the results of the meeting have been to record a definite advance of opinion and resolution in the object for which it was called. The war enabled the engineer to come into his own. The nation needs him no less in times of peace, and when he realizes this fact he will respond nobly.

Commerce and Mining in Argentina

THE constitution of an Argentine-American Chamber of Commerce in New York is one evidence of a welcome *rapprochement* between the United States and the Argentine Republic. The primary object of the new association will be to protect trade interests and advance trade relations between the two countries according to just and equitable principles and methods, to encourage the investment of capital in legitimate enterprises, and to take whatever measures may be practicable to facilitate intercourse and friendly relations.

The proposed objectives are admirable. The obvious result of the purpose of the Chamber to encourage what is desirable, just, and equitable will be to discourage the questionable methods and practices which have tended to keep the industrial and commercial life of the two countries so far separated. The desire for friendly relations must inevitably lead to an attitude of frankness and honesty on both sides, and this augurs well. In addition to fostering the spirit of coöperation and encouraging the idea of mutual interdependence, the Chamber's activities will result in greater publicity for Argentine matters, the dissemination of truthful reports and the appreciation of reliable data. All this will help to clear away many misapprehensions and should encourage expansion and development on a scale commensurate with the aspirations of both countries.

The mining industry in Argentina is looked upon more or less as a joke; and mining engineers are there regarded as quacks and charlatans. Those who take this view have every justification, for the past history of mining in that country has been a lamentable succession of frauds, exploitations made under incompetent advice, and disasters. The contributing cause has been an entire lack of publicity, coupled with an unfortunate isolation from mining camps in successful operation in other parts of the world.

No survey of Argentina's mineral resources has ever been made. Its wealth is therefore unknown even to its own people. Development of outlying districts has been neglected through lack of knowledge of the potentialities of the country. Closer coöperation with the United States should achieve much.

The new Argentine-American Chamber of Commerce will do well to encourage the ventilation of subjects of vital interest to both countries. In course of time we hope to see a more healthful tone exhibited with regard to the mining industry in Argentina, and a recognition of the fact that, in proper hands, it is a legitimate

and highly specialized business, involving skill, initiative, and experience. Publicity will achieve much toward the rehabilitation of the industry, and mutual benefit will result.

The Tungsten Market

SINCE early in last November there has been a great depression in the market for tungsten ores and concentrates. For the greater part of the time there has been no market. Imports have continued and stocks have increased. The tungsten industry is in the throes of readjustment. Until such time as the iron and steel manufacturing plants resume normal activity, and the surplus stocks of high-speed steel, ferrotungsten, and tungsten ores have been disposed of, there will be difficulty in the marketing of the product of tungsten mines.

The high prices for tungsten ores that prevailed during a considerable part of the war period stimulated production to an extraordinary degree. The superficial nature of tungsten deposits makes their exploitation easy in many instances. The simple treatment to which the ores respond makes the winning of a marketable product less difficult than with other ores.

The comprehensive paper on wolfram mining in Bolivia, by G. F. J. Preumont, which we reprint in this issue from the bulletin of the Institution of Mining and Metallurgy, gives an excellent insight into the conditions that exist in foreign tungsten-mining centers. That many of the deposits of the kind described will be rapidly worked out or abandoned when new prices for tungsten ores become established is a foregone conclusion. We may liken the exploitation of such areas to the working of rich gold-placer regions. For a time the production of gold from these regions is large, and then rapidly dwindles. Just as the initial placer mining was succeeded by the working of low-grade placers and lode deposits on a substantial and more or less permanent scale, so will the scattered tungsten-mining operations finally reach a condition of stability in the few well-conducted and thoroughly worked mines that will survive the present conditions in countries like Bolivia, China, India, and the United States.

In our country the tungsten industry has been developed to a large extent upon substantial lines, and, were it not for the foreign tungsten product that presses into our market, there would be a ready sale for all of the ore produced. The prospective market will be one of keen competition between domestic and foreign producers. Prices, without doubt, will be substantially lower than those that prevailed during the last year and may approach the pre-war level. What the attitude of the next Congress on the tariff is to be will be looked forward to with great interest, and will be of far-reaching importance to our domestic tungsten producers.

American Merchant Marine

OF WHAT interest is it to the American miner whether his ore or the product obtained from it is carried abroad in American vessels? What possible interest can he have in a merchant marine? He has an interest, rather indirect, but still a very pronounced interest in supporting the development of a fleet of American merchant vessels.

The miner's direct concern is for ever-broadening markets for his wares—expanding markets meaning greater demand and higher prices for ores and their products. The United States is fortunately situated as to her natural resources for nearly all of her mineral supplies. She has been using an immense tonnage at home and has been exporting a much greater value in mineral products than she has imported. But, large as home consumption is in many minerals, our resources greatly exceed domestic requirements, and that producing properties may work to the best advantage still wider markets are required. The field for these is abroad.

In entering foreign markets we immediately meet competition or restriction in some form. What restriction will develop upon the signing of peace no one can foretell, but self-interest of every European country will insist that its nationals be protected from the aggression of foreign producers. This protection may take the form of tariffs or bonuses, and is more than likely to include subsidies to vessels flying its own flag. We may soon expect to be advised of restrictions that confront us; we know that we will have to pay the freight, and it may easily be that our products will feel the weight of subsidized shipping. Here, then, is the interest of the American miner in using his efforts to see that his output may travel the seas under no greater handicap than that of his competitor. According to Robert Dollar, who writes in Bulletin No. 4, issued by the Merchant Marine Committee of the United States, between 1790 and 1830 fully 90% of our exports were shipped in American vessels, but since then the proportion has gradually dropped, until in the year 1914 it was less than 1%. If economic laws were permitted to take their natural course, if we should trust to the law of supply and demand to furnish the ships, and to the survival of the fittest to furnish us transportation at the lowest rates, the merchants of the United States would in all probability, within a few years, be sending their vessels all over the world; or if some foreign peoples could handle the shipping better than we, they would do that while we produced and manufactured for them.

But economic laws have not been allowed to take their natural course. First one nation and then another has taken steps that self-interest indicated would favor her nationals. And once this procedure was adopted, others have had to or did take steps which their lawmakers thought advisable.

In the United States the laws that have been passed, with the good intention of favoring labor and making for efficiency, have simply resulted in causing the American flag to disappear as a factor in international commerce.

In again referring to the Merchant Marine Committee's Bulletin, previously quoted, we learn that, as a result of the passage of the Seamen's Bill, American shipping on the Pacific Coast dropped in four years from 26 to 2%. Wages were an important item in this, as instanced by two vessels of the same horsepower and tonnage: The one under the Japanese flag carried a crew of 36 men and had a payroll of $770 per month; the other, under the Stars and Stripes, carried a crew of 47 men and had a payroll of $3720 per month.

Our methods of making ship measurements favor foreign vessels; our inspections are allowed to interfere with operations; our engine room and deck crews are larger than required, and the quality of the per-

sonnel is far higher than is the case with our competitors.

If we are to have a merchant marine there must be drastic changes in our present laws before vessels with the American flag can carry our products to foreign ports. Safety need not be sacrificed, wages of the higher-class seamen need not be reduced, but subsidies will probably have to be paid. We all need these vessels, and it is the duty of each of us to urge upon our legislators the necessity of action that will permit of private American enterprise once more becoming a factor in ocean traffic.

Taking the Bull by the Horns

THE statement issued by the Interstate-Callahan, a copy of which appeared in the *Journal* of Mar. 15, has been read by many, no doubt, with keen interest. Other mines are in the same condition; that is, the value of the ore produced has fallen below the cost of production, and the owners are in a quandary as to what to do. The first thought is to take the bull by the horns and do as the Interstate-Callahan has done, shut down until such time as it will again pay to operate the property, for no business can long stand the strain of running at a loss, particularly such a business as mining. Shutting down is not always a simple operation, and seldom means the cessation of all expense. Certain overhead charges must be continued, insurance and taxes must be paid, the machinery and property must be cared for, pumps must be kept running, timber must be renewed, and caving ground must be caught up. The expense of keeping the property in first-class order may be greater than the loss incurred through selling metal at less than cost. Closing down for an indefinite period means the scattering of an important part of the staff and laboring force, and an added expense when the time comes for reorganization.

With the prompt resumption of normal demand for metals, and the steadying of prices for supplies, the gain from cessation of work would scarcely compensate for the loss incurred by continuing operations, but with no prospect of better conditions in the near future the question, to say the least, is serious.

Another important point that the operator must consider is the condition of those who are dependent upon the mine for their daily bread. The dismissal of a small number of men weekly has no appreciable effect upon the mine or community, but the discharge of several hundred at one time is most decidedly a serious matter in a small community. It is a step that may lead quickly to actual want and distress, bringing about greater suffering than would be felt by owners if they lost the whole of their reserves, or even the mine itself.

Legally, a community has no right to ask the mine owners to support it; morally, the workmen are partners in the mine, and if willing to share losses should be protected to the limit by owners.

Whether the mine should be shut down or kept in operation does not depend solely upon the question of profits, but of equal weight are the factors of social and political economy which must be considered, and the mine is fortunate that can do as the Interstate-Callahan has done, and do it with justice to all and without suffering to any.

Some properties are so fortunately circumstanced that a middle course may be taken. They are in a position that will enable them to cease production and yet have at their command sufficient funds available to make it possible to continue the work of prospecting and development. Under existing economic conditions this is the wisest course to pursue if at all practicable.

Production means the addition of metals to a market already overstocked and a lengthening of the time during which abnormal conditions will prevail. Let production lag, but use labor and equipment so far as practicable in opening new reserves and preparing the mine for increased demands that are sure to follow the stagnant period that we have now entered upon. The cost of such development will be higher than good management would sanction, but the metals against which it is charged will sell at a higher price than that now quoted, and altogether it is the best solution of a bad situation.

Mr. Vanderlip's Views

IN A PUBLIC SPEECH early in January, Mr. Vanderlip expressed himself optimistically respecting the economic future, and his other utterances at about that time were of the same nature. But lately he has been looking into things in Europe, and he has been quoted, through The Associated Press, as making the following remarks:

I doubt if America has begun to comprehend the seriousness of the appalling situation which confronts Europe, and the wreck which the whole fabric of civilization may be facing. America was once told there might be peace without victory. What we have is victory without peace. Production has ceased, and unless production can be speedily resumed, one's imagination cannot comprehend the chaos which may ensue. In France everything waits on settlement of the question of indemnity and progress of events in Germany. Each day makes the prospect of indemnity less possible. If production is not resumed, the horrors of war may be exceeded by the horrors of this after period, which is not war nor peace, but a breakdown of the machinery of civilization. In face of such appalling disaster, every partisan consideration, every unessential difference of opinion and every personal ambition, should be instantly forgotten.

Unless terms of peace can be speedily agreed upon, and permit resumption of something approaching normal industrial life, there is not merely a chance, there is a strong probability, of Russian Bolshevism overrunning Germany. What Bolshevism is can never be really pictured by a normal mind. No description of it has been overdrawn. One may say the temperament and psychology of Germany are not such as to lead that country to Bolshevism. Hunger can lead any country into Bolshevism, and hunger is what Central Europe is facing.

There is no economic legerdemain that can correct the financial difficulties of Europe. Production alone can do that. Production in sufficient quantity to permit export of goods alone can permanently support exchanges.

What can America do? There is certainly one thing it cannot do, and that is to withdraw itself, to rest in belief that this chaos is remote and America can avoid playing her part in international responsibility. We must think in international terms as we never thought before. The gigantic strength of our own position will not keep us free from effects of events here. This is no time for narrow or provincial views.

For example, criticism of actions of governments here in excluding our exports shows lack of appreciation of the financial position of these countries. They have sustained exchanges because they could borrow from our Government. When that ability to borrow ends, these countries will be confronted by extreme difficulty in regard to their exchanges. They must avoid every importation it is possible for them to prohibit, to keep down demand for exchange to pay for importations of food and raw materials.

Necessity for machinery is imperative, and these governments are endeavoring to provide that everything possible shall be made within their own borders, because they have not the means to make payments in foreign markets. They may have made some mistakes in laying embargoes, but in general the effort is one with which we sympathize and do not criticize. The absolutely fundamental necessity is not charity. It is not loans. It is organization of production and distribution.

Transportation is breaking down, and there will be sections that cannot be fed even if there were food and plenty in Europe to feed them. The first essential is to look facts in the face until

terms of peace are known and the available indemnity is measured. Any useful indemnity for the time being must be measured in terms of goods, and delay in announcing terms of peace is rapidly moving into the future Germany's ability to produce goods.

The above opinions are practically identical with those expressed by W. R. Ingalls in an address before the Mining and Metallurgical Society of America in January, which was reprinted in the *Journal*.

A fundamental trouble in the world today is that there are so many men who can not work (for reasons beyond their control), or who will not work, thinking that they do not have to do so. The resuscitation of business, even the survival of our civilization, depends upon the people of the world getting to work and working harder than ever before. The slackers and the strikers are enemies of everybody, themselves included. The main thing is to produce. There are many other economic problems, but none so fundamental as this. The impairment of production is the great danger from the spread of Bolshevism.

We think that in America there is an underlying common sense, which often is insufficiently valued, and therefore we do not look for any serious Bolshevism here. But in spite of our strong financial position we cannot escape feeling to some extent the consequences of Bolshevism in Europe.

The excellent article by S. Ford Eaton which is concluded in this issue throws light upon another one of the little known gold-mining regions of South America. American capital and enterprise are steadily pushing their way into the mining regions of the southern continent. That there is a good field here for mining has long been recognized. As in so many other regions, transportation is a serious handicap to mining operations in Colombia. In time South American governments will awaken to the necessity for road development and will apportion a considerable part of their budget for road and trail work. The elimination of repressive laws and the curtailment of onerous taxes, together with the general improvement in transportation facilities, are necessary factors in encouraging foreign miners to open and operate mines in South America.

BY THE WAY

Few persons regard Cuba as a favorable field for gold-mining enterprise, yet in its day the chief revenue of the island was gold. When Columbus landed near Puerto Principe in 1492 he was informed that gold could be found in Cubanacán, a district now known as Santa Clara Province. Later adventurers, under the leadership of Diego Velazquez, did considerable prospecting in the headwaters of the Arimao River and in the vicinity of Guaracabulla and Placetas del Sur. Don Vasco Porcallo de Figueroa arrived in Cuba about the time that Velazquez started the *repartimiento*, or assignment of the natives as slaves, and devoted his energies to gold mining and agriculture. He achieved the reputation of being severe but just; doing more than any other individual from Spain to put the industries of the island on a sound economic basis and striving to make it a land of homes, rather than purely a field for exploitation. When the arrogant and despotic Hernando De Soto arrived from Spain in 1538, with plenipotentiary powers, he was glad to accept the aid of Porcallo, by that time the richest and most powerful resident of the island, in equipping and provisioning the Florida expedition. De Soto, having reduced Nuño de Tovar to the ranks, offered the vacant post of lieutenant-general to the best man available. Though Porcallo was slightly above the draft age, he accepted his commission in the reserve officers' corps and proceeded to active duty with the overseas force, on the understanding that he was at liberty to establish a government labor bureau on the mainland. The slogan was "jobs for Indians," with very little said about the rate of pay. After a few days' sojourn at some of the Florida shore resorts, Vasco noticed that not even by liberal tipping could he obtain satisfactory service. Moreover, not a solitary dollar-a-year man volunteered. Porcallo and De Soto had a lively argument, resulting in the return of the former to Cuba. Many historians seemed unable to learn just what happened; but one Garcilaso de la Vega intimates that old Vasco put on his best tin shirt and went to call on an Indian chief named Hurri Harri. He lost his way in a swamp, his horse fell on him, and when finally extricated he was thoroughly plastered with mud. Returning on foot, he soliloquized: "*Hurri Harri, Hurri Higa, Burra Coja, Carajo.* May the foul fiend take a land where the language is so difficult and the traveling so bad and profitless. I have my mines and plantations and can well afford to retire and enjoy the rest of my life in peace." During the same year of departure from Cuba, 1539, he returned to his home. In 1542, possibly due to the pleas of the humanitarian priest Bartolomé de las Casas, the employment of Indians in the mines was forbidden by royal decree. In 1544 the bishop of Santiago called at Porcallo's home near the present site of San Juan de los Remedios, but learned that his erstwhile host was in Habana visiting and consoling the widow of De Soto. The chief operator of mines having retired from active business, the practical miners having emigrated to Mexico and South America, and the unskilled laborers having been disqualified by royal decree, it is not surprising that gold mining practically ceased in Cuba.

"The original lazy man," says the Old Timer in the *Salt Lake Mining Review*, "the one who made all who preceded him or followed him look like selling platers, was a Kansan who was employed as a watchman at the old Emma mine, in Alta, during its palmy days. We called him 'Bald-faced Billy,' probably because of the whiskers which covered his features—shaving was too much trouble, anyhow. He could neither read nor write; and he was the hero of the story of the man who, when asked how he put in his time, said: 'Why, I jest sit an' think; an' sometimes when it's real hot I jest sit.' But what I started to say about him was this: One afternoon I passed the Emma on my way to the Grizzly, and there was Bill slouched down on a pile of lumber, with his unlighted pipe in his mouth and a finger and thumb of his right hand pressed against the wheel of an ore wagon. 'What's the main idea, Bill?' I asked. 'Huh? Oh,' he said, 'when Edgar here starts his horses, this here wheel will light a match for me.' And he sat there without moving as I passed on."

The Mining Index

This index is a convenient reference to the current literature of mining and metallurgy published in all of the important periodicals of the world. We will furnish a copy of any article (if in print) in the original language for the price quoted. Where no price is quoted the cost is unknown. Inasmuch as the papers must be ordered from the publishers, there will be some delay for the foreign papers. Remittance must be sent with order. Coupons are furnished at the following prices: 20c. each, six for $1, 33 for $5, and 100 for $15. When remittances are made in even dollars, we will return the excess over any order in coupons if so requested.

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GOLD AND SILVER—GEOLOGY

10659—ONTARIO—Notes on Lake Abitibi Area. Percy E. Hopkins. (Ann. Report, Ont. Bureau of Mines, 1918; 15 pp., illus.)

10660—ONTARIO—The Matachewan Gold Area. A. G. Burrows. (Ann. Report, Ont. Bureau of Mines, 1918; 25 pp., illus.)

GOLD DREDGING, PLACER MINING, ETC.

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IRON AND STEEL—METALLURGY

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10680—ELECTRIC FURNACES in the Steel Industry and Their Relation to the Central Station Business. (Chem. and Met. Eng., Jan. 15, 1919; 3¼ pp.)

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10682—FERROMANGANESE—Eliminating Phosphorus and Sulphur in Electric Ferromanganese Furnaces. Jay Lonergan. (Chem. and Met. Eng., Mar. 1, 1919; ¾ p.)

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10697—ALUMINUM—The Inflammability of Aluminum Dust. Alan Leighton. (U. S. Bureau of Mines, 1918; 15 pp.)

10698—ALUMINUM—The Metallography of Aluminum. Robert J. Anderson. (Journ. Frank. Inst., Jan., 1919; 47 pp., illus.) 60c.

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10703—MANGANESE—The Mining and Preparation of Manganese Ores in Tennessee. W. R. Crane. (Resources of Tenn., Jan., 1919; 15½ pp., illus.)

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10710—SECONDARY METALS IN 1917. J. P. Dunlop. (Mineral Resources of the U. S., 1917, Part 1; 31½ pp.)

10711—STELLITE—The Production and Uses of Stellite. Sidney B. Wright. (Bull. Can. Min. Inst., Feb., 1919; 3¾ pp.)

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10718—GRAPHITE—Refining Alabama Flake Graphite for Crucible Use. Frederick G. Moses. (U. S. Bureau of Mines, War Minerals Investigations Series No. 8, 1918; 34¾ pp.)

10719—MAGNESITE—Its Occurrences and Uses. (Min. Mag., Feb., 1919; 4½ pp.) Paper by T. Cook before the Ceramic Society. 40c.

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10724—SULPHUR—American Sulphur Industry Expanding. (Chem. and Met. Eng., Feb. 15, 1919; 2½ pp., illus.) Brief account of the sulphur-bearing saline domes of the Gulf Coast; operations at Matagorda.

PETROLEUM AND NATURAL GAS

10725—FIRES—Extinguishing and Preventing Oil and Gas Fires. C. P. Bowie. (Bull. 170, U. S. Bureau of Mines, 1918; 41¼ pp., illus.)

10726—OIL SHALES—The Present Status of Oil Shales. (Chem. and Met. Eng., Jan. 1, 1919; 3 pp., illus.)

ECONOMIC GEOLOGY—GENERAL

10727—BURMA—The Ore Minerals of Tavoy. J. Morrow Campbell. (Min. Mag., Feb., 1919; 14 pp.) 40c.

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MINING—GENERAL

10730—ACCIDENTS—Mining Accidents in Ontario in 1917. T. F. Sutherland, E. A. Collins and J. H. Stovel. (Ann. Report, Ont. Bureau of Mines, 1918; 5¾ pp.)

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10736—EXPLOSIVES—Methods for Routine Work in the Explosives Physical Laboratory of the Bureau of Mines. S. P. Howell and J. E. Tiffany. (Tech. Paper 186, U. S. Bureau of Mines, 1918; 63 pp.)

10737—EXPLOSIVES—Some Notes on Experiments Made with a View to Reducing the Consumption of Explosives and Increasing the Fathoms Broken per Machine Shift in Machine Stoping. (Journ. So. Afr. Inst. of Engrs., Oct., 1918, and Jan., 1919; 2 pp.) Continued discussion of paper of T. H. Bayldon, previously indexed.

10738—MINE SUPPLIES—Economies in Mining Engineering Supplies. W. Elsdon-Dew. (Journ. So. Afr. Inst. of Engrs., Jan., 1919; 23¾ pp., illus.)

10739—ONTARIO—Mines of Ontario in 1917. T. F. Sutherland, E. A. Collins and J. H. Stovel. (Ann. Report, Ont. Bureau of Mines, 1918; 68¾ pp., illus.)

10740—PROSPECT—Examining and Developing the Mine Prospect. Harry T. Curran. (Eng. and Min. Journ., Feb. 22, 1919; 5¾ pp., illus.) 20c.

10741—QUARRIES—Labor Saving at Limestone Quarries. Oliver Bowles. (Tech. Paper 203, U. S. Bureau of Mines, 1919; 26 pp.)

10742—PUMP CONTROL—Automatic Electrical Control at the Deer Trail. L. Brandenburger. (Salt Lake Min. Rev., Feb. 15, 1919; 2 pp., illus.) 20c.

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10744—SANITARY ENGINEERING in a Tropic Mining Camp. Harry N. Jenks. (Eng. and Min. Journ., Mar. 1, 1919; 3 pp., illus.) Abstracted from Eng. News-Record, Jan. 23, 1919; describes methods of Burma Mines, Ltd. 20c.

10745—SANITATION—A Mine Latrine. William W. Cort. (Min. and Sci. Press, Feb. 1, 1919; 1¼ pp.) 20c.

10746—SHAFTS—The Rectangular Shafts at Randfontein Central G. M. Co., and New State Areas, Ltd. W. L. White. (So. Afr. Min. Journ., Jan. 25, 1919; 1 p.; to be continued.) 40c.

10747—SPAIN—The Mineral Statistics of Spain for 1917. (Min. Journ., Jan. 25, 1919; 2½ pp.) Abstract translated and summarized from "Revista Minera." 40c.

10748—TIMBERING—Inclined-Shaft Timbering and a Method of Alignment. Arthur Neustaedter. (Eng. and Min. Journ., Feb. 22, 1919; 2 pp., illus.) 20c.

10749—TRANSPORTATION—Linking Up Isolated Mineral Districts by the Loco-Tractor Transport System. Frank Dutton. (Eng. and Min. Journ., Feb. 15, 1919; 3¼ pp., illus.) Abstracted from the So. Afr. Journ. of Industries. 20c.

10750—TUNNEL DRIVING at Copper Mountain, B. C. Oscar Lachmund. (Bull. A. I. M. E., Mar., 1919; 4¼ pp., illus.) 40c.

10751—UTAH—Mining in Utah in 1918. Edward R. Zalinski. (Eng. and Min. Journ., Jan. 25, 1919; 5¼ pp.) 20c.

10752—VENEZUELA—The Mineral Industry in Venezuela. Charles F. Z. Caracristi. (Eng. and Min. Journ., Mar. 8, 1919; 3¼ pp.) 20c.

FLOTATION

(See also "Lead and Zinc")

10753—COLLOIDS and Flotation. Frederick G. Moses. (Tech. Paper 200, U. S. Bureau of Mines, 1918; 24 pp.)

10754—FLOCCULATION in Flotation. C. C. Smith and A. R. Pickett. (Eng. and Min. Journ., Feb. 22, 1919; 1 p., illus.) 20c.

10755—PULP-LEVEL CONTROL. Claude T. Rice. (Eng. and Min. Journ., Feb. 22, 1919; 1¾ pp., illus.) 20c.

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ORE DRESSING—GENERAL

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10759—GRINDING AND SIZING DIAGRAMS. Alfred T. Frey. (Min. and Sci. Press, Mar. 8, 1919; 3¼ pp., illus.) 20c.

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METALLURGY—GENERAL

10762—ELECTRIC FURNACE—Temperature Uniformity in an Electric Furnace. John B. Ferguson. (Chem. and Met. Eng., Mar. 15, 1919; 5 pp., illus.) Republished from "Physical Rev."

10763—FUME TREATMENT—Notes on Electrical Precipitators. E. E. Thum. (Chem. and Met. Eng., Jan. 15, 1919; 6 pp., illus.) A summary of operations taken from several installations; notes on power consumption, voltage, velocity and temperature of gases.

10764—ITALY—L'industria Mineraria e Metallurgica Toscana. Gaetano Castelli. (Rassegna Mineraria, Oct., 1918; 5 pp.)

10765—PYROMETRY—Calibration of Base-Metal Thermocouples. C. S. Crouse. (Eng. and Min. Journ., Mar. 8, 1919; 2¼ pp., illus.) 20c.

10766—REFRACTORIES—Contribution a L'Etude de la Brique de Silice et de sa Fabrication. L. Dauphin. (Bull. Soc. de L'Ind. Minerale, Feb., 1918; 53 pp.)

10767—REFRACTORIES—La Fabrication des Briques de Silice. M. Philipon. (Bull. Soc. de L'Ind. Minerale, Feb., 1918; 3 pp.)

10768—REFRACTORY MATERIALS—Action of Slags on Refractory Materials. (Iron Age, Jan. 23, 1919; 1¾ pp.)

10769—REFRACTORY MATERIALS—Influence of Temperature Upon the Action of Slag Upon Refractory Materials. Raymond M. Howe. (Chem. and Met. Eng., Feb. 15, 1919; 1¾ pp.)

FUELS

10770—FUEL ECONOMY in the Boiler House. John B. C. Kershaw. (Chem. and Met. Eng., Feb. 15, Mar. 1 and 15, 1919; 11 pp., illus.)

10772—FURNACES—Low-Rate Combustion in Fuel Beds of Hand-Fired Furnaces. Henry Kreisinger, C. E. Augustine and S. H. Katz. (Tech. Paper 139, U. S. Bureau of Mines, 1918; 52 pp., illus.)

10773—PEAT in 1917. C. C. Osborn. (Mineral Resources of the U. S., 1917, Part 2; 27 pp., illus.)

10774—PULVERIZED COAL for Metallurgical Furnaces. Charles E. Longenecker. (Iron Age, Feb. 6, 1919; 1¾ pp., illus.)

10775—PULVERIZED COAL—Pulverized Coal in Blast Furnaces at Plant of International Nickel Co. W. L. Wotherspoon. (Can. Min. Journ., Feb. 5, 1919; 1 p.) 20c.

MINING AND METALLURGICAL MACHINERY

10776—AIR COMPRESSORS—Lubrication of Air Compressors. H. V. Conrad. (Eng. and Min. Journ., Mar. 1, 1919; 2¾ pp.) 20c.

10777—AIR LIFT—The Compound Air Lift. A. W. Allen. (Eng. and Min. Journ., Mar. 8, 1919; 1¾ pp., illus.) 20c.

10778—BELTING—Substitutes for Leather Belting. Harry A. Hey. (Industrial Management, Mar., 1919; 1¾ pp.)

10779—DRILL—The Hand Hammer Drill. James P. Cotter. (Bull. Can. Min. Inst., Feb., 1919; 4¼ pp.)

10780—PUMP SELECTION—Points in Pump Selection. B. N. Everett. (Chem. and Met. Eng., Mar. 1, 1919; 1¼ pp.)

Personals

Harry J. Wolf, of the Malm Wolf Co., is in El Paso on professional business.

E. Norris Hobart has been appointed Assistant State Engineer of New Mexico, at Santa Fe.

C. E. Wharton, of Salt Lake City, has returned from a visit to the Bankburnett oil fields of Texas.

Irving A. Palmer is in the Cripple Creek district with a party of 40 students of the Colorado School of Mines.

W. R. Calvert, of Salt Lake City, has returned from a professional visit to the Washington County oil fields.

A. J. Seltzer, former chemist for the Bartlesville Zinc Co., Blackwell, Okla., has opened an assay office in Picher, Oklahoma.

E. T. Casler, formerly chemist for the Phosphate Mining Co., Nichols, Fla., is now chemist with the Air Nitrates Corporation.

D. C. Jackling has been making a visit of inspection to the Utah copper mine at Bingham and the company mills at Garfield.

John F. Coats, mining engineer of Vancouver, B. C., made an examination recently of several properties near Placerville, California.

John A. Savage, of Duluth, attended the conference of iron and steel representatives at Washington, D. C., as a member of the iron-ore branch.

E. M. Hamilton, of the firm of Hamilton Beauchamp, Woodworth, Inc., metallurgical engineers, of San Francisco, has returned from Parral, Mexico.

R. T. White, South American manager for the A. S. & R., has been in Salt Lake City recently, making visits from that point to the company's plants in Salt Lake Valley.

Lieut.-Col. John C. Greenway, 101st Infantry, has been awarded the Distinguished Service Cross for extraordinary heroism in action near Verdun, France, on Oct. 23 1918.

Lieut. Carrol F. Reece, 102d Infantry, has been awarded the Distinguished Service Cross for extraordinary heroism in action near Bois de Warville, France, on Oct. 2, 1918.

Rush T. Sill, of the firm of Sill & Sill, mining and metallurgical engineers of Los Angeles, announces the removal of the firm's offices and laboratory to 1011 Figueroa Street.

H. D. Trounce has accepted a position with the explosives division of the Bureau of Mines, with headquarters in Washington, D. C. His address will be Room 1128, The New Interior Building.

Albert Ladd Colby, consulting engineer and iron and steel metallurgist of South Bethlehem, Penn., is the representative of the American Society for Testing Materials on Engineering Council.

A. H. Hubbell, News Editor of the "Journal," started on Mar. 31 on an extensive trip, in which he will visit Canadian and Western mining districts in the news interests of the "Journal."

R. M. Crocker has been recently discharged from the engineering corps at Camp Humphreys, Va., and is again engaged in mining-engineering work, with offices at 407 Dooly Block, Salt Lake City.

Albert Burch, of the firm of Burch, Caetani & Hershey, of San Francisco, arrived in Placerville, Calif., recently, and made a preliminary examination of the Church-Union group of gold-quartz claims.

O. P. Hood is to be in charge of an experimental plant to be used in the investigation of domestic deposits of lignite and peat for commercial uses which the Secretary of the Interior has been authorized to make.

W. B. Devereux has returned from overseas, where he served in the aviation branch with the rank of major. He has received his discharge and will resume his connection with the firm of Wilkens & Devereux, New York.

Leslie R. Pyle, supervisor of the fuel-conservation section of the U. S. Railroad Administration, and **Charles M. Freeman,** assistant supervisor, arrived in Salt Lake City recently to make a survey of the Oregon Short Line fuel system.

Joseph T. Terry, Jr., who for some time has been engaged in conducting flotation experiments for the American Zinc Co., Mascot, Tenn., has opened an office as a consulting engineer under the title Terry Mining and Metallurgical Corporation, at Salt Lake City.

W. R. Doell has resigned as chief engineer of the Wisconsin Steel Co's. coal and coke works at Benham, Ky., and with **Holman I. Pearl,** has taken over the business of **J. F. Wolff,** mining engineer and geologist of Crosby, Minn., under the name of Associated Engineers.

Theodore Chapin, geologist attached to the Alaskan Engineering Commission, and **Sumner Smith,** superintendent of mining in Alaska, are to be the civilian members on a commission which will also include three naval officers, yet to be named, to survey the Matanuska coal field. The commission sailed from the Bremerton navy yard about April 1.

C. K. Leith, professor of geology at the University of Wisconsin, has returned from Paris, where he served as mineral adviser in the Economic Section of the American Peace Commission, and will resume his work at Madison. Prior to going to Paris, Professor Leith performed mineral advisory work for the Shipping, War Industries and War Trade Boards in Washington, D. C.

C. F. Kelly, president Anaconda Copper Mining Co.; **R. L. Agassiz,** president Calumet & Hecla Mining Co.; **Joseph Clendenin,** vice-president A. S. & R., and **Walter Douglas,** president Phelps Dodge Corporation, who represented the Copper Export Association and have spent two months in Europe making a survey of the prospects of immediate copper sales abroad, returned on March 30.

Herbert Salinger, who has been connected with Beer, Sondheimer & Co. and the National Zinc Co. as ore buyer, has announced that he has purchased the interest of Kirk & Leavall in the Western Metals Co., of Salt Lake. He intends to extend the present operations of the company in lead and zinc ores into the rare-ore field, including tungsten, chrome, manganese, vanadium, molybdenum, bismuth and other ores.

Dwight E. Woodbridge, of Duluth, is chairman of the new iron-ore subcommittee of the iron and steel committee of the American Institute of Mining and Metallurgical Engineers. The following compose the membership: **Charles A. Buck,** vice-president Bethlehem Steel Co.; **E. F. Burchard,** U. S. Geological Survey; **Charles Catlett,** consulting engineer, Staunton, Va.; **R. C. Allen,** state geologist of Michigan; **George C. Crawford,** president Tennessee Coal, Iron and Railroad Co.; **W. O. Hotchkiss,** state geologist of Wisconsin; **W. J. Penhallegon,** manager mines and quarries, Republic Iron & Steel Co., Birmingham, Ala.; **Charles F. Rand,** president Spanish-American Iron Co.; **William Kelly,** president Penn Iron Mining Co.; **W. G. Swart,** manager Mesabi Syndicate, Duluth; **Oscar B. Warren,** mine manager, Longyear & Bennett.

Obituary

S. S. Rosenstamm, prominent in the copper-sales industry, died on Mar. 30 in New York. He had been associated with Adolph Lewisohn & Sons for a number of years in charge of sales of copper for that firm, which marketed the production of Miami and Shattuck-Arizona Copper companies. Mr. Rosenstamm started with the old firm of Lewisohn Bros., which was succeeded by the United Metals Selling Co. at the time of the organization of the Amalgamated Copper Co. After a number of years with the latter company he again became connected with Mr. Lewisohn. Mr. Rosenstamm was a director of the Miami Copper, Tennessee Copper, Kerr Lake, and General Development companies. He had been deeply interested in Hebrew charities and enthusiastic in welfare work among the soldiers.

Leonard C. Hanna, member of the firm of M. A. Hanna & Co., Cleveland, and brother of the late Senator Marcus A. Hanna, founder of the firm, died on Mar. 21, at the age of 68 years. Mr. Hanna was long identified with iron mining and smelting, in addition to coal mining and transportation. In 1872, he formed a business association with E. M. Saunders, the former president of the Northwestern Fuel Co., in the coal business, but became connected with his brother's firm, M. A. Hanna & Co., in 1875, being admitted to partnership in 1879, and taking charge of its iron-ore and vessel business. When M. A. Hanna became prominent in national affairs, L. C. Hanna took complete charge of the company. He retired in 1905, and reëntered the firm again in 1915. Under his management, the business had grown to large proportions and the firm was the owner of the largest fleet on the Lakes. Mr. Hanna was also president of the Lake Superior Iron Ore Association for nine years, president of the Claire Furnace Co., a Hanna interest; director and member of the executive committee of the Republic Iron and Steel Co., and director of the Cleveland Railway Co., the Great Lakes Towing Co., the Kelly Island Line and Transport Co., and various other companies.

Societies

Mining and Metallurgical Society of America held a meeting of the New York Section at the Columbia Club on Apr. 3. Meyer Bloomfield, who has just returned from England, made an address on "The Labor Situation in Great Britain and America."

American Welding Society held the first meeting on Mar. 28 at the Engineering Societies Building and the constitution and bylaws were adopted as recommended by the organization committee. The following officers were elected: President, C. A. Adams, Cambridge, Mass.; vice-president (for one year), J. M. Morehead, New York; vice-president (for two years), G. L. Brunner, Utica. Twenty-four directors, including those for one, two and three years, were also elected. It was voted that the charter should be held open for 10 days and that those applying for membership before Apr. 8 should be considered charter members. At a meeting of the directors in the afternoon W. E. Symons was appointed treasurer and H. C. Forbes secretary.

Industrial News

American Gear Manufacturers' Association will hold the annual convention at the Hotel Statler, Cleveland, Apr. 14, 15 and 16. Papers will be presented on "Gear Steels," "Proper Sizes and Materials for Gears," and "Worms and Worm Wheels."

Huff Electrostatic Separator Co., of Boston, has promised to lend one of the company's separators, with complete electrical equipment, to the department of metallurgy and ore dressing of the Arizona Bureau of Mines for use in instruction and research.

W. A. Jones Foundry and Machine Co., of Chicago, manufacturers of a complete line of power transmission apparatus, special foundry machinery, and the Jones spur gear speed reducer, have opened an eastern office at 30 Church St., New York, under the direction of Lemuel C. Biglow, who formerly for a number of years held a similar position with the Morse Chain Co., of Ithaca, New York.

Zionist Society of Engineers and Agriculturists, 122 East 37th St., New York, is desirous of receiving the coöperation of American manufacturers in order to be in a position to select and recommend the subsequent purchase of tools, machinery and other equipment to be used in the reclamation work in Palestine. This organization is planning to send an engineering commission to Palestine to make a survey of natural resources.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each.

Copper, Hydrometallurgy of. William N. Rossberg and Guy E. Sheridan, Butte, Mont. (U. S. No. 1,292,075; Jan. 21, 1919.)

Electrolytic Cell. Elmer E. Niswonger, Dayton, Ohio, and Paul McDorman, Niagara Falls, N. Y., assignors to the Electro Chemical Co., Dayton, Ohio. (U. S. No. 1,292,024; Jan. 21, 1919.)

Flotation. Process of Recovering Metals From Ores. Rudolf Gahl, Miami, Ariz. (U. S. No. 1,291,824; Jan. 21, 1919.)

Manganese. Process of Extracting Values From Manganese and Other Ores. Edward W. Haslup, Bronxville, N. Y., and Benjamin A. Peacock, Philadelphia, Penn.; said Peacock assignor to said Haslup. (U. S. No. 1,291,867; Jan. 21, 1919.)

Mine Cages, Safety Device for. Alex. G. Biondi, Los Angeles, Calif. (U. S. No. 1,292,236; Jan. 21, 1919.)

Miner's Gold-Pan. Edward O. C. Ord, U. S. Army. (U. S. No. 1,292,364; Jan. 21, 1919.)

Radium, Art of Recovering. H. N. McCoy, Chicago, Ill., assignor to Carnotite Reduction Co., Chicago, Ill. (U. S. No. 1,292,341, Jan. 21, 1919.)

Editorial Correspondence

SAN FRANCISCO—Mar. 31

Argonaut Mine Fire Under Control and bulkheading of the Muldoon up-cast shaft and Argonaut working shaft is proceeding. The fire occurred on the 4000 level on Mar. 28. H. M. Wolfin, chief of mine inspection of the Industrial Accident Commission; C. H. Fry, of the California Metal Producers' Association, and Edwin Higgins, mining engineer for Bulkeley Wells, assisted Manager Kelsey while the rescue services of the Grass Valley, Kennett, and Shawmut properties were brought to the scene.

Natomas Company, of California, net earnings in the calendar year 1918 amounted to only $749,119, as compared to $1,099,309 in 1917. The causes were high costs of materials, scarcity of labor, and curtailment in the use of power, all as results of conditions due to the war. The gross earnings amounted to $2,008,966 in 1918, and $2,303,000 in 1917. At the reorganization of the company in 1914, 13 dredges were in operation, ten at Natoma and three at Oroville. Seven have closed operations, and three new ones have been installed, the present number in operation in the two fields being nine.

Bonanza Days on the Comstock were recalled in the week ended Mar. 15 by the extraction of $40.50 ore from Ophir 1800 level. The mine produced in the week a total of 259 tons, valued at $7455, or an average of $24.92 per ton. In the same week, Consolidated Virginia produced 342 tons, of a total value of $11,029, or an average of $32.24 per ton. The aggregate production of the two mines in the week amounted to 601 tons, valued at $18,584, the largest weekly production from the Northend Comstock in several years. All this ore came from the 1800, 1900, 2000 and 2150 levels, evidence that the upper levels of the Comstock were not cleaned in the Bonanza days. In the week ended Mar. 8, Ophir produced 246 tons, valued at $4256, and Consolidated Virginia, 353 tons, at $8203, or a total of 599 tons from the two mines, having a total of $12,459, or an average of $20.80 per ton. This makes a total production from the two mines in the first half of March of $31,043, from 1200 tons of ore, of an average value of $25.86 per ton. Consolidated Virginia shaft, known as the C. & C., had so long been used for pumping installations and operation for all the Northend Comstock mines that even the upper levels, known to still contain large bodies of good ore, could not be economically mined on a large scale until the completion of the unwatering of the entire Northend down to the 2900 level, which was in July, 1917. Even then only a comparatively small amount of ore could be hoisted through the C. & C. shaft. When development made connection with the Union, which is the main working shaft of the Northend mines, the extraction and hoisting of ore from the Consolidated Virginia increased. Ophir was in similar position, the shaft being used only for ventilation and the lowering of timbers and supplies, and repair operations. Ophir is now connected, and these two mines are supplying the necessary ore while development and repairs are in progress in Union, Mexican and Sierra Nevada. There have been times in the last two years when all these Northend mines were producing some ore simultaneously. But there still remain to be accomplished a great deal of development in the upper levels and exploration in the lower levels and connection to a second upcast shaft before the Northend Comstock mines can all be made profitably productive on the large scale of which they are evidently capable. This is the purpose to which Whitman Symmes, manager, is working and has been working for several years.

BUTTE, MONT.—Mar. 30

Fourteen Anaconda Properties Not Producing ore at the present time, but are closed down under the curtailment plan. The mines, however, with two or three exceptions, are either undergoing repairs, or development work is going on, so that a considerable force is employed. Seventeen properties are in operation, but they are not working to capacity. The mines closed are the Leonard, High Ore, Mountain Consolidated, Mountain View, Moonlight, Belmont, Bonanza, Liquidator, Orphan Girl, Lexington, Original, Pennsylvania, Neversweat, and Anaconda. The properties in operation are the Bell, Silver Bow, East Colusa, Tropic, Tramway, West Colusa, Poulin, Badger State, Southern Cross, Berkeley, Alice, Steward, St. Lawrence, Emma, West Gray Rock, and Nettie. Unless copper conditions improve in the next few months, there are a number of the mines, now closed so far as hoisting ore is concerned, which will remain closed for many months, but when the time does arrive to resume work they will be in a position to operate to capacity.

Reduction of Anaconda Dividend by 50c. a share, together with continued unsettled condition of the metal market and labor troubles again looming up, has given rise to a rumor that a shutdown was imminent, which, however, has been definitely denied. The possibility of a general closing of the mines for probably several months, or at least until such time as the owners of the properties can operate at a profit, has been discussed among the general public, based on the reason that the company cannot be expected to keep on producing copper just for the purpose of furnishing employment. Since the curtailment, the Anaconda company has been employing none but married men or persons who have dependents. All soldiers returning from the service who were in the employ of the company when they entered the service, and who have not any home or means to provide themselves with board and lodging, are being furnished with the same free of charge, and as soon as they secure employment they start out free of debt.

The number of idle men in the district among the miners is not as large as a few months ago, because of the fact that the young men are seeking employment elsewhere. Some are going to work on farms, which now offer a good rate of wages; others secure work at small mining districts where persons are opening up silver properties. Silver mines which had been operated many years ago and which were good producers, but had to close on account of the lack of demand for the metal, are being reopened by Eastern capital, equipped with modern machinery. This is particularly true in the Philipsburg, Alder Gulch, and Basin districts. In addition to the Anaconda properties, the Butte & Superior and North Butte mines are working under a 60 to 65% curtailment.

SALT LAKE CITY, UTAH—Mar. 27

As to the Taxation of Metalliferous Mines in Utah, which has been occupying the attention of the mining interests for some time, it now appears that taxation will, after all, be fixed at the rate of three times the net proceeds, instead of at "not to exceed three times the net proceeds," as the State Senate has accepted the amendment of the House to the above effect. The only way out would be a veto of the Governor, who has been in favor of the bill as originally passed by the Senate "at not to exceed three times the net proceeds."

The U. S. Bureau of Mines at the University of Utah shows in its February report that much work was done during the month on the volatilization process for low-grade and complex ores of the state, on potash investigation (in this connection a process for treating low-grade alunite from Marysvale being sought, whereby both potash and byproduct can be recovered) on ore dressing, and in the treatment of oil shales from Utah and in the territory of surrounding states.

SPOKANE, WASH.—Mar. 28

Mother Lode Copper Mines Co., of Alaska, has been permitted to consummate the sale of its property to Stephen Birch, who agreed to organize a corporation known as Mother Lode Coalition Mines Co., which would take over and operate the property, according to a decision of the Supreme Court of the State of Washington dismissing an injunction obtained by an objecting stockholder on Nov. 15, 1918. This is the substance of a statement in which is summed up the legal effect of the decision given out by James J. Godfrey, president of the company:

"The importance of this decision is far reaching, because it validates the contract of May 7, 1918, between Stephen Birch and the Mother Lode Co. and leaves the road open for immediate consummation of that contract. Likewise it validates in advance securities of the Mother Lode Coalition Mines Co. before they are issued. It also effectually bars any attempt at further litigation based upon this contract. Mother Lode Coalition Mines Co. will file its articles of incorporation in Delaware and immediately take over properties now owned and operated by Mother Lode Copper Mines Co. of Alaska."

WALLACE, IDAHO—Mar. 28.

Hecla Mining Co.'s report for the year ended Dec. 31, 1918, shows a net income from ore sales of $3,996,061; income from other sources brings the total receipts up to $4,035,338. Expenditures for mining and development, $1,245,724; ore sorting, $86,542; hauling from mine to mill, $41,248; milling, $167,392; general expense, insurance and taxes, $306,547. Total expenditures, $1,847,554; net income, $2,187,783; depreciation, $133,066; net profit for the year, $2,054,716. Assets listed in balance sheet include mining property, $4,309,942; permanent improvements, $1,055,474; Liberty bonds, $251,150; U. S. certificates of indebtedness, $1,575,000; ore in transit, $311,290, and cash, $88,046, the total assets being $7,833,025. Liabilities are accounts payable, $76,932; reserves for depreciation, $479,288; property surplus, $4,082,842; surplus, $2,943,962, making the total $7,583,025, from which is deducted capital stock, $250,000. During the year the company milled 309,656 tons of ore and shipped 15,133 tons crude, the gross operating expense, mining and milling, being $4.865 per ton. Total shipments were 52,893 tons; value, $3,996,061; value per ton, $75.549. Cost of production, $1,847,554; cost per ton, $34,929. Silver produced, 1,590,062 oz.; lead, 51,365,676 lb.; zinc, 433,341 lb. It required 8.19 tons milling ore to produce one ton of concentrates, and 7.18 tons of material was raised to produce one ton of shipping product. Ore reserves are estimated at 1,584,115 tons, being about five years' supply at the rate of production of the period covered by the report. Dividends for the year were $350,000, and total paid by the company was $7,255,000. A drift being run on 2000 level will open orebody at depth of 400 ft. below present lowest workings. The report states that the income and excess-profits tax for 1917 is still undetermined, and that the tax for 1918 will be undetermined until the first is settled.

PHOENIX, ARIZ.—Mar. 28

The Fourth State Legislature has adjourned with little action taken on mining subjects. Among the measures killed were the English-speaking bill, aimed at the Mexican labor camps of Ray, Ajo and the Clifton district; a bill calling for electrical blasting, a bill for marking time on fuse wrappers, a new hoisting-signal code, and measures creating the office of boiler inspector, making liens on mining claims for labor run till date of payment of full wages, and providing a state hospital and home for miners, with appropriation of 5% of the state's total tax on mines and taxing private employment agencies out of business. Among the acts passed were: Demanding establishment of heated change rooms in smelteries and reduction works, with shower baths and toilet facilities; defining mine-boundary marks to be six substantial posts, projecting at least four feet from the ground, or substantial stone monuments, at least three feet high; allowing condemnation of private ways of necessity over mining claims; granting a bonus of $10,000 for the first Arizona oil well that shall produce at least 50 bbl. a day for a week; making it a misdemeanor to utter false statements in matter printed in of-

fering for sale any real or personal property; providing a regular tax upon capitalization for investigation of all companies that offer stock for sale. The last, especially drawn against "wild-cat" mining and oil companies, already is in effect, with William Graham, of Phoenix, as inspector, under the Corporation Commission.

The legislative commission appointed two years ago to secure data concerning the proposed establishment of a state smeltery and sampling works reported that it had taken no action. The presiding officers of the two houses have been authorized to appoint three members each on a new commission, which is allotted a $5000 expense account.

JOPLIN, MO.—Mar. 29

An Effort to Decrease Royalties on properties in the Oklahoma section by interesting the Federal Government in lowering high charges is being discussed here. It is pointed out that many Indians are receiving no income from their lands, owing to the fact that the excessive royalties charged by owners of the second, third and fourth leases make it impossible for the company holding the ultimate operating lease to continue production.

Prohibitive Tariff on Zinc Ores is wanted by operators in this field, and an effort will be made to obtain it. Following a talk by Congressman R. W. McPherson before the mine operators and business men of Webb City, a committee of ten men, one-half operators and one-half from other businesses, was selected to coöperate with the Representative to get a tariff. Mr. McPherson frankly stated his position as favoring a tariff high enough completely to stop zinc-ore importations from Mexico.

Profit-Sharing for Mine Workers has been decided upon by the Miami Wonder Mining Co., operating a concentrator about a mile southeast of Picher, Okla. Definite details have not been worked out, but it is proposed that every worker at the property, both above and below the ground, shall benefit from any profits that are made above actual production costs. Such a plan has been talked of in this district before, but this is the first company actually to give the scheme a trial. Fred D. Whiting, of Oklahoma City, is president.

BIRMINGHAM, ALA.—Mar. 27

The Birmingham District is now being seriously affected by the general slowing down of the iron and steel business throughout the country. Opinion is divided on prospects, though pessimism is not rampant. Many think that the situation is a little dubious, but all are confident that the buying movement may bring about a change from the uncertainty that exists.

There is not a large amount of iron in furnace yards in the Birmingham district. About 42,000 tons of off-basic iron is said to be stored, with not more than 50,000 to 60,000 of analysis iron to be found. Curtailment of production has not stopped, two furnaces being scheduled to go out of blast this week. The furnace at Sheffield has banked fires. The Republic Iron and Steel Co. has two furnaces in blast at Thomas, with some iron noticed in yards. The Sloss-Sheffield Steel and Iron Co. has three furnaces in operation, the Alabama Co. has two going, one at Ironton and one at Gadsen, but there is doubt as to the future. A decision will be reached, it is expected, within the next two or three days. The Central Coal and Iron Co. has a furnace in operation at Holt. The Shelby Iron Co. is making charcoal iron.

Operations at all plants of the Woodward Iron Co. have been gradually slowing down since the first of the year. During March three furnaces at Woodward and the one at Vanderbilt have been banked, and all plants at Bessemer, except the byproducts works closed on Mar. 15. As a result of this slowing down, several hundred employees have been thrown out of work, though few are inconvenienced, owing to the gradual closing; in fact the mines and other large centers of employment have been running at half time and some even less for the last few months. The company has made no statement in regard to this general closing down. It is believed to be only temporary, because of the fact that the furnaces were banked and not blown out and arrangements were made through the company's employment bureau to keep the labor close at hand. The company's vertical shaft, known as Woodward No. 4, has reached a vertical depth from the surface of 1200 ft. This shaft will be carried to a point 1300 ft. below the surface, which is slightly below the ore measure, and development work done in the ore. Good progress has been made, everything considered, and an average of about 100 ft. a month maintained, even during the war period and extreme labor shortage. The sinking will be completed early in April. The work was held back considerably during the last month, because of encountering chert, this being particularly hard to drill. The E. J. Longyear Co., of Minneapolis, is contractor on this work and has made rapid progress, owing to good organization.

The Sloss-Sheffield Steel and Iron Co. is now running four and five days a week, eight hours a day. The 120 byproduct coke ovens, under construction at North Birmingham, will be completed this autumn. The Government had contracted to take practically all the byproducts of these ovens, and, though the company has been asked to suspend construction of the plant, it will be completed and the Government asked to compensate the company for the loss of earnings under the terms of the contract. The production of this company shows a decrease for the last year as against the prior two years in coal, iron and coke, the most important factor having been labor. More than 700 employees went to war, and a great demand existed for labor on Government construction in the territories where the company's properties are situated. The brown-ore mines at Russellville are being closed this week.

No changes have been made in the operations of the Republic Iron and Steel Co., and at present there is no indication of change. The furnaces are running on the same schedule followed throughout the war, and it is fair to say that this company is almost alone in this respect. This condition is largely owing to the furnaces being kept in repair during the war period and the high cost absorbed by the high iron market. The production at the company's Raimund group of mines has been steadily upward for the last three months. As the ore from these mines is self-fluxing, the cost of coke and fuel used in reducing it is lower than for any other ores of the company and most of the company's competitors, and the furnaces consume it as rapidly as mined. For this reason there is little probability of these mines being closed, although a great deal of work neglected during the war for the sake of production must now be carried out. The company's Spaulding mines are now stocking, and, though this ore is not so valuable as the Raimund ore, there is no indication of these mines closing. Electric tramming is now in operation at Spaulding, it being the first ore mine in Alabama to adopt electric haulage. This is no innovation, and only the backwardness of operators has prevented them from using it, as it has been used in other districts and is one of the economies that will have to be worked out. Electric tramming is bound to come as the distances become greater and if labor is to be maintained at the present high scale.

On Mar. 17 the keel of the first steel ship to be built by the Chickasaw Ship Building Co., a subsidiary of the Tennessee Coal, Iron and Railroad Co., was laid at Mobile, Ala. The steel was produced at the Tennessee company's steel mills at Ensley, Ala., worked over at the big Fairfield plant, and sent to the shipyards. Fabrication of steel plates is now being done at the Mobile fabricating plant, and, as the Fairfield plant is rapidly progressing toward completion, it is expected to begin the fabrication of steel plates there by the middle of April, the plate and blooming mills already being operated. The plans of the company are to lay keels until eight ships are under construction at one time, plenty of steel being in sight. It is understood that the first ships built are for the use of the company, but there is no doubt the increased demand after the peace settlement will use all the company can build. At present there has been no general cut in wages or force, though the employment and accounting departments have had some reductions, and in the operating departments of all plants a close trimming is taking place, with the view of weeding out extra or incompetent men the company was forced to employ during the war period. Of the five furnaces owned by this company in Bessemer, one is down for repairs and two are down for lack of orders for pig iron. The hot metal from the other two furnaces is being shipped direct to Ensley for use in the steel mill.

The blast furnace of the Gulf States Steel Co. at Gadsen, Ala., is scheduled to go out of blast this week. This company has three of its six openhearth furnaces in operation. Plenty of basic iron is on hand, hence the decision to shut down the blast furnace at Gadsen. There are still a number of orders on hand for finished steel products, wire nails, and like materials, but no new business is reported. The company's Shannon mine, which had been sunk to a depth of about 2000 ft., with a year more to go before reaching ore, was closed during March.

DULUTH, MINN.—Mar. 27

Shipments of Iron Ore from the Mesabi Range will be greatly facilitated from this time on by the operation of the new ore dock which the Duluth, Missabe & Northern R. R. will put in service on or about May 1. The new dock is known as No. 6, and in all its dimensions is the largest of its kind in the world. It is 2438 ft. long, 84 ft. high and with a storage capacity of 3000 cars, or 153,000 tons, it outstrips its nearest competitor by 33,000 tons, or the equivalent of a cargo each for three of the largest Lake freighters. It was built by the American Bridge Co., and cost $3,500,000.

The Preliminary Mineral Survey of about 300,000 acres of cut-over timber land situated in northeastern Minnesota has been ordered continued by the directors of the Virginia & Rainy Lake Co. The survey was started some time ago by Prof. C. K. Leith, and later suspended by press of other affairs. It is now about half finished, and Professor Leith has been directed to complete the work as soon as possible. Many portions of the tract are adjacent to operating mines, and a good deal of it lies at the extremities of both the Mesabi and Vermilion ranges as now established.

HOUGHTON, MICH.—Mar. 27

Calumet & Hecla's Action in passing the quarterly dividend is the most actively discussed subject in the Michigan mining district. This is due to the fact that a larger proportion of Calumet & Hecla stock is owned in Michigan than of any other mining company and because a great number of Calumet & Hecla shareholders here depend for their livelihood on the company's dividends. Generally the deferred dividend action has been accepted by shareholders as marking a course in consideration of the rights of employees that is radical and new, but justified. The fact is understood here that the company today does not know whether it is operating at a profit or a loss. It is not selling enough copper under existing conditions to show anything. Though the treasury surplus is large, it will be needed if the organization is to be kept together during this period of depression and be able to carry the output of copper, which continues to accumulate by the hundreds of thousands of pounds.

TORONTO, ONTARIO—Mar. 28

The "Sale of Shares Act," generally known as the "blue-sky law," was introduced in a modified form on Mar. 26 in the Ontario Legislature by Hon. I. B. Lucas, Attorney General. The clauses respecting the shares of mining companies or syndicates were stricken out, Mr. Lucas stating that the government had been deluged with objections to this feature of the bill, on which it had been found impossible to get any basis of agreement. He further intimated that it was doubtful whether the measure in any form would be passed at this session, as the question of proceeding with it, or leaving it for further consideration, would be determined by the attitude of the members when it came up for discussion at a later date. As this is the position taken by the government, it seems altogether probable that the bill will be shelved for the present. Though much of the opposition to the bill so far as it concerned the mining interests came from promoters of doubtful enterprises or those having shares of little or no value to dispose of, there was at the same time, a strong feeling among mining men that the measure would adversely affect legitimate undertakings. Although admitting the desirability of further legislation to protect the public against fraud and misrepresentation, they looked with considerable distrust upon the proposal to place arbitrary powers in the hands of a commissioner, who would probably owe his appointment to political influence and might be entirely unqualified by technical knowledge or experience for the duties of the position. The success or failure of the law, it was urged, would be entirely dependent upon its administration by the commissioner, and considering the frequency with which the public interest is sacrificed to political expediency in making such appointments, the risk of serious detriment to the mining industry counterbalanced any possible advantage to be secured by the enactment of such a law.

The Mining News

ARIZONA

Cochise County

PHELPS DODGE CORPORATION (Bisbee)—Plan to resume work on concentrator.

Gila County

IRON CAP MINES (Globe) — Having plans prepared by D. Cole for a mill.

Mohave County

SILVER BELL EXPLORATION (Hackberry)—Has been incorporated by W. W. Lewis, who will drive 400-ft. tunnel on steep hillside to vein, 30 in. wide, sampling $25 at 100 ft. of shaft depth.

NEW COMSTOCK (Kingman)—At local meeting, company arranged for financing development of Catherine mine, in Blue Ridge range, lately examined by O. H. Hershey. Milling ore 33 ft. wide has been crosscut beyond faulting that caused abandonment several years ago. W. C. Howard, manager.

RICO EXPLORATION (Kingman) — Shipped carload to Humboldt, sampling $360 in gold and silver. Ore was taken out by M. C. Cleveland, manager, in drifting operations.

WALDRON (Kingman) — Will drift on 600 level to southward. George Hill in charge.

UNITED EASTERN (Oatman) — Has secured injunction against Tom Reed company, preventing any working in ground claimed by latter under alleged apex rights.

Pinal County

MAGMA COPPER (Superior)—February production of copper was 1,211,175 lb.; January, 900,000 pounds.

Santa Cruz County

AMERICAN BOY-HOSEY (Patagonia)—Lease taken from Clarke & Peterson by Gross & Kennedy, of Duluth, who will build wagon road, install adequate surface equipment, and sink shaft 300 feet.

CALIFORNIA (Patagonia)—Operated by Bethel & Wilson, with reported cutting of 6 ft. of commercial ore.

DUQUESNE (Patagonia)—Started upon development with view toward possible erection of mill.

EL PASO (Patagonia)—Property near Mowry, under management of W. J. Mitchell, sinking shaft to 400 ft., to strike sulphides. Company has $35,000 surface plant. Mr. Mitchell also managing nearby Olive mine for Arizona Consolidated Copper Mines Company.

HARDSHELL (Patagonia)—Shipped a carload of good ore taken out in sinking new shaft. New hoist has been installed.

MORNING GLORY (Patagonia) — Will ship 500 tons manganese a month. Manganese also now being shipped from Salvadore property.

MOWRY (Patagonia) — New strike of silver-lead found on 250 level. Experimental mill planned by company's main stockholder, A. J. Hazeltine, of Warren, Penn., now on ground. Manganese lease on same property operated by Shaw & Daughs.

THREE R (Patagonia) — Several new chutes of good copper ore cut at depth.

Yavapai County

CONSOLIDATED ARIZONA (Humboldt)—G. M. Calvocoresses, manager, states the payroll has been reduced less than 50% and now numbers 400 employes in all departments. The Blue Bell and De Sota will be kept in operation, and only loss will be in custom patronage.

GADSDEN (Jerome)—Drift on 1200 level passing through shist carrying particles of chalcopyrite and native copper.

UNITED VERDE EXTENSION (Jerome)—Planning to build extensions to copper smeltery.

BOGGS (Mayer)—E. E. Hill, of Mayer, has purchased of Douglas, Lacy & Co., of New York, the tailings dump of the old Boggs-Hackberry smeltery, first operated by the Commercial Mining Co., a Phelps Dodge corporation. The ore was basic, heap-roasted, and contents of the slag and tailings are said to be recoverable by flotation concentration.

BRADY (Mayer)—Old property in Turkey Creek district showing high-grade silver ore at bottom of 150 ft. shaft. Charles Batre, of Big Ledge Co., and James O'Brien, of the Henrietta, interested.

LIBERTY (Mayer)—Preparing to sink to 1000 ft. and installing new hoist and compressor. D. G. Kidder, in charge.

ARIZONA BINGHAMTON (Prescott)—Having plans prepared by D. Cole for the construction of a mill and tramway. Estimated cost is several hundred thousand dollars.

RUBY SILVER, DESORIS AND BLUE DICK (Prescott)—Three old silver producers in the Jersey Lily belt are to be reopened. Ruby Silver has already completed about 200 ft. of development tunnel.

ARKANSAS

Boone County

HARVEY (Zinc)—The J. P. Harvey Mining Co. started operations again on property in Coon Hollow; making good production of hand-cobbed silicate of zinc. Also taking out considerable rich mill ore.

RHODES-MANCHESTER (Zinc) — The McCurry Mining and Milling Co., operating this and other mines in this camp, will start work on a concentrating plant at once. Machinery has been purchased. Plant will be of 100 tons' capacity. Ore developed for continuous operation.

Marion County

LONNIE BOY (Rush)—Articles of incorporation were filed at Yellville and at Little Rock this week for the Lonnie Boy Mining Co., which is operating the zinc mine at this place. Officers are: W. E. Layton, president; Pat McCormick, vice-president, and Stanley Hanford, secretary and treasurer. Work in progress at the property, and results satisfactory.

CALIFORNIA

Amador County

EAST EUREKA (Sutter Creek)—To retreat sulphurets from 20-stamp mill not operating for several years. Mine was developed and produced good ore, but through improper management was forced to close.

OLD EUREKA (Sutter Creek)—To build station at 3000 ft. depth, the lowest point of shaft.

Calaveras County

HERZER (Railroad Flat)—Reported that agents of George Wingfield are sampling this and Fritz Seeman mine. Recent strike of good ore in latter reported.

Madera County

SIDNEY COPPER (Raymond)—Installing leaching plant. Ore to be hauled on motor trucks from mine at Green Mountain.

Nevada County

IDAHO-MARYLAND GOLD MINES CO. (Grass Valley)—Incorporated with $3,000,000 capitalization to operate Idaho-Maryland mines. Metals Recovery Co., of New York, is the holding company, which recently also took over the Gold Point and Union Hill.

CHAMPION (Nevada City)—Good grade of ore extracted. Full crew employed. Opening new territory.

THREE SEVENS GOLD MINES CO. (Nevada City)—New incorporation substituted for the Norambague Consolidated. New York men, owners.

Riverside County

SILICA ORE mined at Murietta is shipped to Los Angeles for use in manufacture of pressed brick. Large tonnage reported.

San Luis Obispo County

MANGANESE ORE recently shipped through San Luis Obispo reported to have sold at San Francisco at $40 per ton, the ore containing 54% manganese, 17% dioxide, 2.4% silica. The same grade of ore sold previously at $125 per ton, and A. H. Simpson, the shipper, states the operation is unprofitable.

Santa Clara County

MAGNESITE MINES at Morgan Hill reported closed and 50 men out, owing to the declining market since the signing of the armistice.

COLORADO

Teller County

PORTLAND (Cripple Creek) — Has opened promising bodies of high-grade ore in new development of lower levels.

IDAHO

Kootenai County

OLD HICKORY (Cœur d'Alene)—Drift reported run 300 ft. from tunnel level following oreshoot 2 to 4 ft. wide. Wood being used for fuel, because of lack of coal, and power for machine drills being obtained from star property. Employing two shifts.

Shoshone County

COPPER KING (Mullan)—Work will begin Apr. 1 by parties under bond and lease. Bond is for $250,000, $10,000 payable first year, $40,000 the second, and $50,000 each year thereafter. Bond also provides for construction of mill of at least 50 tons' daily capacity and to keep not less than 14 men employed continuously. Estimated that 3000 tons milling ore, lead-silver, on the dump, with much ore available in mine.

IDAHO-CARBONATE HILL (Mullan)—W. D. Greenough, president, announces work will be resumed about May 15. Shaft down 400 ft. Will crosscut nearby vein and continue sinking to 1000 feet.

COLUMBUS (Murray)—Contract let to drive crosscut 100 ft. to intersect second vein. Main tunnel in 800 ft., with considerable lead-silver ore, but not of commercial quantity. Owned by Pennsylvania and New Jersey interests.

KANSAS

Joplin District

BLUE MOUND (Baxter)—Has started sinking new shaft near north line to tap run being mined by Webber.

MAGIC (Treece, Kan.)—Has two shafts just down to ore northwest of Blue Mound. Jesse Graham, Coffeyville, Kan., president.

MINNESOTA

Cuyuna Range

CROFT (Crosby)—Put on few men Mar. 17; cleaning up mine, closed since Dec. 1. Will start actual mining operations soon.

Mesabi Range

MISSABE MOUNTAIN (Virginia)—Operating three shovels and ten locomotives on stripping. One shovel removing taconite along the north bank of Missabe Mountain, Lone Jack, and Ohio properties.

Vermilion Range

CHIPPEWA IRON (Ely)—Sinking shaft to depth of 300 ft. Shaft bottomed in partly clean ore.

SOUTH CHANDLER (Ely)—Producing 6000 tons per month; normal production about 10,000 tons.

MISSOURI

Joplin District

HEATON-HODGES (Granby) — Have begun sinking shaft on sheet ground section developed during last six months by drilling. Expect to sink four shafts and erect at least one large concentrator. Ten-inch hole put down for Pomona pump to help in shaft sinking. Ore lies below 210 ft. of solid lime formation. Warren Heaton, Granby, manager.

MONTANA

Granite County

SCRATCH ALL (Philipsburg)—Reported that considerable high-grade silver ore has been struck. Former producer.

TRUE FISSURE (Philipsburg)—Showing of high-grade silver ore, according to reports, has been struck. Shaft now down 500 ft. to be sunk to 1000 ft. depth.

Jefferson County

AMALGAMATED SILVER (Clancy)—Stoping silver ore for shipment from 100 and 250 levels on Free Coinage vein.

DAN TUCKER (Clancy)—Silver-bearing ore, in shaft at 280 ft. depth. Work to be resumed in April.

LLOYD-CROSSLEY STRIKE (Wickes)—Copper-silver ore at depth of 700 ft. in drift from breast of tunnel.

MOUNT WASHINGTON MINE (Wickes)—New strike in 4000-ft. tunnel breast changing to copper ore. Vein 40 ft. wide.

Lewis and Clark County

CRUSE CONSOLIDATED (Helena)—Drifting and crosscutting to contact vein at 400 level. Silver-lead ore in shaft vein.

WHITLATCH GOLD (Helena)—Shaft 500 ft. deep. Streak of commercial gold ore uncovered west of shaft at 450-ft. depth. Mill of 25 tons' capacity on the ground. Electric power.

PEERLESS QUEEN (Rimini)—Bunches of silver ore at 250 level.

NEVADA

Clark County

YELLOW PINE MINING (Goodsprings)—Discontinued shipments of zinc concentrates. Mill continued operating and zinc concentrates stored; lead concentrates shipped until Mar. 10, when mill shut down because of fire at mine on Mar. 6, which destroyed hoisting equipment. Installation of new hoist, compressors and electrical equipment expected to be in operation on Mar. 15. Mill being completely overhauled and calcining plant being installed for treatment of zinc concentrates during interval of shutdown. Morris P. Kirk, general manager.

Esmeralda County

TONAPAH DISTRICT ore production for week ended Mar. 15 was 7351 tons, valued at $124,967. Producers were: The Tonapah Belmont, 2259 tons; Tonapah Mining, 1050 tons; Tonapah Extension, 2220 tons; West End, 800 tons; Montana, 171 tons; Tonapah Divide, 245 tons; Jim Butler, 221 tons; MacNamara, 210 tons; Midway, 75 tons; Halifax, 100 tons.

Lyon County

MASON VALLEY MINES (Thompson)—February production of copper was 947,336 lb.; January, 1,111,000 pounds.

Nye County

ALLIED DIVIDE (Divide)—Owns four claims adjoining on south of Merced claim of East Divide. H. B. Ruhl agent and Gust Hanson manager.

BEN HUR (Divide)—Developing group east of Rosetta in eastern part of district.

DIVIDE ANNEX (Divide)—Has two claims adjoining Mammoth claim of Divide. Starting work. E. J. Ramsey secretary and agent.

DIVIDE CITY (Divide)—Adjoining Mammoth claim of Divide group; on main road, and will be site of Divide townsite. J. H. Miller president.

FLORENCE DIVIDE (Divide)—Installing hoisting equipment on group adjoining Sutherland Divide on southeast. J. H. Miller president.

GOLD REEF DIVIDE (Divide)—Owns group of five claims adjoining Gold Zone and Alto. Walter C. Lamb heads new company.

GOLD SEAM DIVIDE (Divide)—Nearly adjoins Rosetta, and has been worked for some time. M. E. Arnold manager.

GOLDSMITH DIVIDE (Divide)—Owns Gypsy claim, near Ben Hur.

GOLD WEDGE DIVIDE (Divide)—Started sinking on group in southeastern part of district. E. H. Mead secretary and W. G. Hellier superintendent.

HIGH DIVIDE EXTENSION (Divide)—Adjoins High Divide on north.

MOHAWK DIVIDE (Divide)—Will sink deep shaft on large group adjoining Divide Consolidated on west. J. H. Miller president.

NORTH DIVIDE (Divide)—Has good plant and is sinking on group adjoining Sutherland Divide on west. W. E. Davis superintendent.

ROSETTA DIVIDE (Divide)—Will sink new shaft. D. F. Murphy manager.

SILVER KING DIVIDE (Divide)—Machinery on ground and shaft started. Gust Hanson manager.

HIGH DIVIDE (Divide)—Property, owned by Wingfield and Brougher, embraces high, cone-like mountain east of Tonopah Divide and adjoining East Divide on the north. Work will be conducted on a broad scale. William Watters superintendent.

ALTO DIVIDE (Divide)—Property, adjoining Gold Zone and East Divide, well equipped, and compressor will supply air also to East Divide. Sinking in progress on Alto No. 2 claim, near East Divide vein. Joe Mayer president and manager.

White Pine County

NEVADA CONSOLIDATED (McGill)—Will open a new company store at McGill; also at Ruth.

OKLAHOMA

Joplin District.

CHOCTAW CHIEF (Hockerville)—Taken over and being operated by W. H. Logan and associates.

UNDERWRITERS' (Joplin, Mo.)—Have put mules in No. 2 mine.

GOOD LUCK (Lincolnville)—Being operated by Mather Concentrating Co. Mill has been working tailings, but will handle mine-run dirt once more.

PROSPECTORS' (Miami)—Building new concentrator near Hockerville.

ANNA BEAVER (Picher)—Sinking new shaft on No. 2 property. Both mills idle, but expected to be in operation soon.

TEXAS

Matagorda County

TEXAS GULF SULPHUR CO. (Gulf)—On Mar. 18 pumping to first well started and production of sulphur began following day at rate of over 400 tons every 24 hours. On Mar. 23, second well started to produce, and two wells now making about 1000 tons daily, or about capacity of present plant.

UTAH

Juab County

TINTIC SHIPMENTS, week ended Mar. 22, amounted to 141 cars, or about 7000 tons, valued at $250,000.

CENTENNIAL-EUREKA (Eureka)—Winze from 1900 level understood to have been sunk 100 ft. below level; station cut preparatory to drifting. Water encountered below 1900, but flow not excessive.

CHIEF CONSOLIDATED (Eureka)—Sinking of No. 2 shaft, after completion of concreting thus far, resumed; concreting in future to be carried on at same time as sinking. Work to be pushed to 1000 level, from which connection with ore-showing in Plutus can be made, and this property developed to best advantage. Prospecting by churn drill new territory in eastern end. Assessment work to be done on individual claims rather than in central place.

GOSHEN VALLEY RAILROAD (Eureka)—Work started on this branch line from near Elbert to reach Tintic Standard and Iron King mines and furnish general outlet for eastern end of district. Line to be seven miles long, and hope to have operations well under way by July 1.

LEHI-TINTIC (Eureka)—Connections between new tunnel and older workings, in which some ore was left, to be completed within 200 ft. Better air available, and cheaper operation possible with connection.

TINTIC MILLING (Silver City)—Shipped 35-ton car of bullion in week ended Mar. 22. Value was higher than usual, being worth from $60,000 to $70,000. Mill treating 200 tons of ore daily, most of which coming from Dragon Consolidated under lease.

Salt Lake County

COLUMBUS-REXALL (Alta)—Five hundred-foot raise almost completed to bottom of old Toledo shaft reported to contain rich ore. Shipping good tonnage of low-grade ore from general clean-up.

OLD EMMA MINES (Alta)—This company, adjoining the Emma Copper, and Emma Consolidated, holding company for 90% of Old Emma Mines and Emma Copper stock, to be reorganized, and new company, a Utah corporation, to be formed. Columbia Trust Co. appointed trustee to handle Emma Mines. Assessment of 10c. per share announced, which will probably furnish funds to pay all amounts required, and leave working capital of approximately $100,000.

MIDVALE MINERALS (Midvale)—Has added considerable new equipment, including 90-ft. Dorr thickener of 500-ton capacity and centrifugal machine of 200-ton capacity per 24 hours for separation of finely disseminated lead from zinc. Product from latter shows 55 to 60% lead and 28 to 42% zinc.

Tooele County

WESTERN UTAH COPPER (Gold Hill)—Operations, after temporary shutdown, resumed; crew of 40 men, now working, to be increased. Shaft sunk to 700 level, 400 ft. below level productive last year, and crosscut being driven for ore expected at 300 ft. from shaft. Ore in this property grows richer with depth. Average contents on 300 level: Silver, 5.5 oz.; lead, 13%; copper, 2%. Mill at Salt Springs, 27 miles from mine at Gold Hill, treating 50 tons daily, to be moved to property and enlarged.

Summit County

PARK CITY SHIPMENTS, week ended Mar. 22 amounted to 1325 tons, as compared with 2034 tons the week preceding. Usual large shippers except Silver King Consolidated, but tonnages in general smaller.

WASHINGTON

Ferry County

QUILP (Republic)—Has resumed production after being closed several years. Stoping on large body of ore carrying gold and silver.

CANADA

British Columbia

GRANBY MINING, SMELTING AND POWER CO. (Anyox)—Expected to resume operations on Apr. 1. Plant closed the first week in March, when property was damaged by fire.

LOUIS CREEK MINING CO. (Louis Creek)—Has installed machinery for recovery of gold.

NELSON M. AND D. (Nelson)—Option purchased from P. J. Sheridan, of Nelson, on following properties in Lardo River Valley: Comstock, Noonday, Silver Hill, White Water, Barker, Rambler, Markwell, Spokane, March, Six Friends, and Volunteer. Consideration $60,000, to be paid over four-year period.

CONSOLIDATED M. AND S. (Trail)—Shipments received of ore and concentrates in first two months of 1919 totaled 65,733 tons, compared with 61,393 in same period of 1918, when five-week strike of smeltermen took place, and with 77,537 tons in 1917.

REPUBLIC (Slocan City)—Car of good-grade silver-gold ore recently shipped. Development work progressing.

Ontario

ADANAC (Cobalt)—Additional high-grade ore found on 310 level.

LA ROSE (Cobalt)—Report for 1918 shows production of 288,556 oz. of silver.

OXFORD (Cobalt)—Begining the development of two claims in the Keewatin area, opposite the Kerr Lake.

HITCHCOCK (Elk Lake)—Six-inch vein of high grade encountered at depth of 116 feet.

LAKE SHORE (Kirkland Lake)—In February mill ran 98.8% of possible running time, treating 1651 tons of ore and recovering $41,605, or an average of $25.20 a ton.

MINAKER-KIRKLAND (Kirkland Lake)—Operations recently resumed and a number of well-mineralized veins opened up on the surface. Shaft being put down on one of them. John W. Morrison, manager.

TECK HUGHES (Kirkland Lake)—In February treated 1683 tons of ore, averaging $10.97 a ton, as compared with 2459 tons, averaging $8.62, in January.

ASSOCIATED GOLDFIELDS (Larder Lake)—Number of employees increased to 75. Showings of gold ore encounted on 500-ft. level of Block B. Diamond drilling will soon be started.

DAVIDSON (Porcupine)—Preparing to start 10-stamp mill.

DOME MINES (Porcupine)—C. D. Keading, general manager, has returned from British Columbia. Work of installing large underground crusher will probably occupy about one month. Reopening of the mill is expected about the middle of May.

Quebec

MARTIN GOLD MINES (Hurricanaw Area)—Small mill installed, but production has so far been intermittent. Shaft is down 90 feet.

The Market Report

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Mar. Apr.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
27	4.5850	101⅛	49 7/16	31	4.5850	101⅛	49⅛
28	4.5850	101⅛	50	1	4.5825	101⅛	49 7/16
29	4.5800	101⅛	49⅛	2	4.6100	101⅛	49 7/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Mar. Apr.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
	15.05		5.20	4.90	6.17½
27	@15.10	†	@5.25	@4.95	@6.22½
	15.05		5.22½	4.95	6.17½
28	@15.15	†	@5.25	@5.00	@6.22½
	15.10		5.22½	4.95	6.17½
29	@15.15	†	@5.25	@5.00	@6.22½
	15.25				6.17½
31	@15.35	†	5.25	5.00	@6.22½
	15.30		5.22½		6.20
1	@15.35	†	@5.25	5.00	@6.25
	15.30		5.22½		6.20¼
2	@15.40	†	@5.25	5.00	@6.25

† No quotations.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

LONDON

Mar. Apr.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
27	79	77	83½	238	235¼	28	26½	39
28	78	77	83½	236½	234	27	26	39
29								
31	78	76½	84	233½	232	28	26	38½
1	79	78	84½	226½	224½	27	25	37½
2	80½	79½	84½	219½	217½	26½	25	38½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Apr. 2, 1919

The metal markets this week were characterized by continuance of the substantial demand for copper, which resulted in a further advance in price. Zinc and lead were featureless.

New export rates are about to be put into effect on export traffic to the Orient and Australia. The rates apply from the Missouri River and east through Pacific Coast ports. The new rates apply to several mineral commodities, as follows. Pig iron, 55c.; pig lead, 75c.; spelter, 75c.; zinc plates and sheets, 80 cents.

Copper—The business on a large scale that we reported last week halted on Wednesday and Thursday, immediately following the advance in price to 15¼c., regular terms. On Friday, however, large business started at that price, and on Saturday some very large business was done, still at the same price, though before the end of the day some producers advanced to 15⅜c., regular terms, and got small orders at that price. On Monday business in diminished volume was done at 15⅜c., regular terms, but, nevertheless, sufficient to cause some producers to feel justified in advancing their price to 15½c. before the end of the day. Some business was done at that price. The business of Tuesday was in the main done at 15½c., regular terms, but all producers did not come fully up to that price. On Wednesday, however, the market was fully established at that figure.

The volume of business transacted during the week was satisfactory, considering that it was wholly for domestic account. Buying was quite general, brass makers, wire drawers, and sheet rollers all participating.

The committee of the Export Association, comprising Messrs. Kelley, Clendenin, Douglas, and Agassiz, which has been abroad investigating foreign conditions and making business arrangements, returned on Sunday last. A public statement was issued on Monday, to the effect that business from abroad was not immediately to be expected, but might reasonably be looked for in the course of time.

Trading in copper was begun on the New York Metal Exchange on Mar. 31. The daily transactions have been insignificant. The big producers take no interest in the matter.

The trade is grieved over the death of Sam Rosenstamm on Mar. 30. He was a well-known figure in the selling of copper and was popular and highly asteemed.

Copper Sheets—The base price of copper sheets is 22½c. per lb. Copper wire is quoted at 17½@17¾c. per lb. f.o.b. mill, carload lots.

Tin—The situation is unchanged. Smelters being prohibited from selling anything, the only source of supply is the metal that is being distributed through the agency of the Government at 72½ cents.

Lead—The business of the week was light. One reason for the apparent dullness in this market is the large amount of lead that goes into consumption on average-price contracts. At present the proportion of the lead disposed of in this way is much larger than it was a little while ago when production was larger. Respecting business that was the subject of negotiation, there was more inquiry this week, especially in the latter part of it, and there was a firmer tone to the market.

Spanish smelters have been supplying lead to Belgium. With the present freight rate of 1½c. per lb. and with sterling exchange at 4.58, it is very difficult for Mexican lead to be sold in Europe.

Zinc—Small business was done from day to day on the basis of about 6.20c., St. Louis. On Apr. 1 news was received of strikes of smeltermen in some of the plants in Oklahoma in resistance to reduction of wages announced for that day. The two plants of the Bartlesville Zinc Co. at Bartlesville and the plant of the United States Zinc Co. at Sand Springs, are reported idle. At the other works in Oklahoma the smeltermen have accepted the reductions. On the news of the labor troubles, the spelter market stiffened a little.

Zinc Sheets—The quoted price of zinc sheets is $11 per 100 pounds.

Other Metals

Aluminum—Prices quoted range from 29@31c. Unchanged.

Antimony—The market was dull at 6⅛@6⅝c. for spot. April-May shipments were quoted at 6½ cents.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Fair business was reported at $67@70. Stocks in this market are reported to be only moderate. On the other hand, buying is merely of hand-to-mouth character. San Francisco telegraphs $70, steady.

Silver and Platinum

Silver—There is no change in the New York official price, but, owing to the improvement of London sterling rates, the London fixed price has declined to 49 7/16d. London shipments last week were about 540,000 ounces.

A typographical error occurred in the New York silver quotation for Mar. 25. The corrected quotation is 101⅛c.

On Mar. 8 there were in Shanghai, according to Pixley & Abell's circular, 28,100,000 taels of sycee and 16,800,000 Mexican dollars.

Mexican dollars at New York: Mar. 27, 77½; Mar. 28, 77½; Mar. 29, 77½; Mar. 31, 77½; Apr. 1, 77½; Apr. 2, 77½.

Platinum—Unchanged at $99@100 for refined ingot.

Palladium—We quote $115@125.

Zinc and Lead Ore Markets

Joplin, Mo., Mar. 29—Blende, per ton, high, $43.15; basis 60% zinc, premium grades, $40; Prime Western, $37.50; sludge, $35; flotation, $33; calamine, basis 40% zinc, $26@25. Average selling prices; Blende, $41.47; calamine, $30.44; all zinc ores, $41.13.

Lead, high, $63.70; basis 80% lead, $60; average selling price, all grades of lead, $57.46 per ton.

Shipments the week: Blende, 11,801; calamine, 369; lead, 1650 tons. Value, all ores the week, $594,440.

A large portion of sellers declined to accept offerings of the lower level of this week, and purchases for Kansas, Oklahoma and Arkansas smelters were light. These smelters announced to workmen some time ago the necessity of a lower wage level to take effect Apr. 1. Smeltery workmen, it is reported, have announced they will not accept the reduction. As it looks now there is a chance that a number of these smelteries will go on dead fire, or close, if the workmen hold against the lower wage.

Platteville, Wis., Mar. 29—Blende, basis 60% zinc, $42.50 base for premium grade and $40 base for high-lead blende.

Lead ore, basis 80% lead, $55 per ton. Shipments reported for the week are 2091 tons blende and 54 tons galena. For the year to date the totals are 23,479 tons blende, 1033 tons galena, and 73 tons sulphur ore. During the week 3591 tons blende was shipped to separating plants.

Other Ores

Tungsten Ore—Charles Hardy reports under date of Apr. 1 as follows: "During the last week the tungsten situation has improved somewhat. There were still several small lots of Eastern ore offered for sale at low prices, but most of these lots have now been eliminated, and it has been impossible to fill a large order, as the quantity available amounted to only a small tonnage. Orders of 50 and 100 tons could not be secured, as most of the Eastern ore is held in strong hands and sellers are unwilling to accept such low prices as $6, which was accepted for the lots referred to. According to information from the West, there is only one mine working in the United States at the present moment, and this mine is only working to keep within the terms of the lease. Inasmuch as the mines in Bolivia, the Argentine and Burma, are also reported to have curtailed their production, if our stocks are not increased by further arrivals the tungsten situation should work itself to a more normal level."

Molybdenum Ore—No business was reported.

Pyrites—Spanish pyrites is quoted at 17c. on the basis of 10s. ocean freight. Unchanged.

Iron Trade Review

PITTSBURGH—Apr. 1

To all, or nearly all, iron and steel producers the results of the recent price reductions have been disappointing. It is true there has been heavier buying of finished steel products since the reduction, but for three or four weeks, while the reductions were in abeyance, there had been greatly reduced buying, and the common theory was that buyers were holding orders back so as to secure the benefit of the reductions. The buying now is not sufficient to make up the deficit. Of course, if buying would have decreased just the same if no promise had appeared of prospective reductions, then the industry is better off. No buying has come from any new quarter. The specifications and orders are coming from the same buyers as formerly, so that there is no indication that the price reductions operated to stimulate demand.

The steel trade adheres to its theory that price is not the consideration, that buyers are not ready to take hold, no matter what prices are quoted. It is held that next fall is the earliest time at which any widespread buying movement will occur. While the new prices are less than a fortnight old, the statement made at the time of their promulgation, that they were to hold for the remainder of the year, is being forgotten. Buyers, at least, will soon begin looking for another reduction. With the large profits shown for 1918 by earnings reports, computed by adding net earnings, taxes and various war-time adjustments together, steel buyers have no difficulty in seeing that war-time prices afforded large profits per ton, while the reductions to date have been relatively light.

Following the reduction of $5 a net ton in wire products and $7 a net ton in other hot-rolled products, makers of various descriptions of manufactured steel are reducing prices. Cold-rolled shafting is reduced $7 a ton to 28% off list; rivets are down $10 a ton to 3.70c. and cold-rolled strip steel is down $12 a ton to 5.65 cents.

Pig Iron—While the reduction in steel prices brought an improvement in demand, there is practically no improvement in pig iron, the market presenting scarcely any inquiry. Most furnaces have adopted the new prices. A few state that they have not, their object doubtless being to strengthen their position in refusing to adjust old contracts. While Pickands, Brown & Co., Chicago, notified all customers that they would bill contract customers at the new prices, beginning Mar. 21, the case is exceptional and not representative of the pig-iron trade generally. The Standard Sanitary Manufacturing Co. is inquiring for 3500 tons of southern iron for April and May delivery to its Louisville plant. W. P. Snyder & Co. announce their computation of March averages at $31.14 for bessemer and $30 for basic, at Valley furnaces. The market is quotable as follows: Bessemer, $27.95; basic, $25.75; No. 2 foundry, $26.75; malleable, $26.25; forge, $25.75, f.o.b. Valley furnaces, with $1.40 freight to Pittsburgh. The average quoted price on foundry iron in March was $27.72, Valley.

Steel—There is scarcely any inquiry, and none of importance. Specifications on sheet-bar contracts have improved somewhat, but mills are specifying only for immediate needs. Discard and shell steel continues to be available at special prices. For regular, soft-steel makers are adhering to recognized quotations: Billets, $38.50; 2-in. billets, $42; sheet bars, $42; slabs, $41; rods, $52.

Ferroalloys

Ferromanganese—Some of the furnaces have reduced their asking price on 80% ferromanganese from $200 to $150, delivered, but resale material continues available at $130, delivered. Demand is light or the resale material would be eliminated. Resale spiegeleisen is available at $42, shipping point, for 18%.

Coke

Coke—A meeting of coke operators in Uniontown last week developed the idea that furnace coke ought to bring $4.50 and that production should be restricted to actual requirements. Whether this will cause quotations at $4 to disappear remains to be seen. Operators are asking $4.50 for April coke on monthly adjustment contracts, but will probably agree to $4.25, as was done with the majority of such contracts for March. Week before last production was just under 200,000 tons in the Connellsville and Lower Connellsville, and the decrease in production continues this week. Some ordinary grades of foundry coke are available at $4.50, while a few makers quote $5.50 and even $6, chiefly to protect their contract shipments.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	.....	36.963	47.215	.....
May	74.745	99.505	.....	37.940	48.980	.....
June	76.971	99.500	.....	39.065	48.875	.....
July	79.010	99.625	.....	40.110	48.813	.....
Aug.	85.407	100.292	.....	43.418	49.077	.....
Sept.	100.740	101.125	.....	50.920	49.500	.....
Oct.	87.332	101.125	.....	44.324	49.500	.....
Nov.	85.891	101.125	.....	43.584	48.969	.....
Dec.	85.960	101.125	.....	43.052	48.492	.....
Year	81.417	96.772	.....	40.851	47.516	.....

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	.....	110.000	.....	125.000	.....
May	23.500	.....	110.000	.....	125.000	.....
June	23.500	.....	110.000	.....	125.000	.....
July	25.904	.....	119.913	.....	134.913	.....
Aug.	26.000	.....	122.000	.....	137.000	.....
Sept.	26.000	.....	122.000	.....	137.000	.....
Oct.	26.000	.....	122.000	.....	137.000	.....
Nov.	26.000	.....	122.000	.....	137.000	.....
Dec.	(a)	.....	118.447	.....	133.167	.....
Year	24.628	.....	115.530	.....	130.507	.....

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	.....	329.905	.....
May	(a)	.....	364.217	.....
June	(a)	.....	331.925	.....
July	(a)	.....	360.347	.....
August	(a)	.....	380.900	.....
September	(a)	.....	343.905	.....
October	(a)	.....	335.543	.....
November	(a)	.....	323.550	.....
December	(a)	.....	267.736	.....
Av. year	(a)	.....	330.138	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.754	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	.....	6.701	.....	29.00	.....
May	6.818	.....	6.704	.....	29.00	.....
June	7.611	.....	7.511	.....	29.00	.....
July	8.033	.....	7.750	.....	29.00	.....
August	8.050	.....	7.750	.....	29.00	.....
September	8.050	.....	7.750	.....	29.00	.....
October	8.050	.....	7.750	.....	29.00	.....
November	8.050	.....	7.750	.....	31.20	.....
December	6.564	.....	6.324	.....	40.00	.....
Year	7.413	.....	7.222	.....	30.10	.....

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	.....	6.715	.....	54.000	.....
May	7.314	.....	7.114	.....	54.000	.....
June	8.021	.....	7.791	.....	54.000	.....
July	8.688	.....	8.338	.....	54.000	.....
August	8.985	.....	8.635	.....	54.000	.....
September	9.442	.....	9.092	.....	54.000	.....
October	8.801	.....	8.451	.....	54.000	.....
November	8.491	.....	8.141	.....	54.100	.....
December	8.163	.....	7.813	.....	56.050	.....
Year	8.159	.....	7.890	.....	54.180	.....

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15	.....	32.95	.....	33.95	.....
May	36.20	.....	33.00	.....	34.00	.....
June	36.36	.....	33.16	.....	34.16	.....
July	36.60	.....	33.40	.....	34.40	.....
August	36.60	.....	33.40	.....	34.40	.....
September	36.60	.....	33.40	.....	34.40	.....
October	36.60	.....	34.40	.....	35.40	.....
November	36.60	.....	34.40	.....	35.40	.....
December	36.60	.....	34.40	.....	35.40	.....
Year	$36.67	.....	$33.70	.....	$34.45	.....

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.† Apr. 1	
Alaska Gold M.	3⅛
Alaska Juneau	2⅛
Am.Sm.&Ref.,com.	69⅛
Am.Sm. & Ref., pf.	104
Am.Sm.Sec., pf., A	92⅛
Am. Zinc	13⅛
Am. Zinc, pf.	43
Anaconda	61⅛
Batopilas Min.	1⅛
Bethlehem Steel	69⅛
Butte & Superior	22⅛
Butte Cop. & Zinc	6⅛
Cerro de Pasco	37⅛
Chile Cop.	23⅛
Chino	35⅛
Colo. Fuel & Iron	42
Crucible Steel	66
Crucible Steel, pf.	93⅛
Dome Mines	12⅛
Federal M. & S.	8⅛
Federal M. & S., pf.	36
Great Nor., ore ctf.	41
Greene Cananea	43⅛
Gulf States Steel	53
Homestake	98
Inspiration Con.	49⅛
International Nickel	26⅛
Kennecott	31⅛
Lackawanna Steel	69⅛
Mexican Petrol.	180⅛
Miami Copper	23⅛
Nat'l Lead, com.	68
National Lead, pf.	109
Nev. Consol.	16⅛
Ontario Min.	6⅛
Ray Con.	20⅛
Republic I.&S., com.	82
Republic I.&S., pf.	102
Sloss-Sheffield	52
Tennessee C. & C.	13⅛
U. S. Steel, com.	98⅛
U. S. Steel, pf.	114⅛
Utah Copper	75⅛
Va. Iron C. & C.	55
Worthington Pump	65⅛

BOSTON CURB* Apr. 1	
Alaska Mines Corp.	‡.12
Boston Ely	1⅛
Boston & Mont.	.54
Butte & Lon'n Dev.	.11
Calaveras	1
Chief Con.	3⅛
Contact	‡.05
Corbin	‡.25
Cortez	.12
Crown Reserve	48
Crystal Cop.	25
Eagle & Blue Bell	2⅛
First Nat. Cop.	‡1⅛
Houghton Copper	.15
Intermountain	‡.05
Iron Blossom	.35
Iron Cap	.10
Majestic	.10
Mexican Metals	.22
Mines of America	‡.05
Mojave Tungsten	.04
Nat. Zinc & Lead	.08
Nevada-Douglas	.15
New Baltic	1
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	‡.05
Yukon Gold	.70

SAN FRAN.* Mar. 31	
Alta	.01
Andes	.10
Best & Belcher	.06
Caledonia	.25
Challenge Con.	‡.03
Confidence	‡.03
Con. Virginia	.53
Gould & Curry	.03
Hale & Norcross	.15
Jacket-Cr. Pt.	.05
Mexican	.17
Occidental	.40
Ophir	.50
Overman	.02
Savage	.07
Sierra Nevada	.15
Union Con.	.17
Utah Con.	‡.02
Belmont	‡3.50
Jim Butler	.32
MacNamara	.53
Midway	.32
Mont.-Tonopah	.18
North Star	.09
Rescue Eula	.08
West End Con.	1.10
Atlanta	.05
Booth	.32
Comb. Frac.	.03
Florence	.70
Jumbo Extension	.14
Kewanas	.06
Nevada Hills	.03
Nevada Packard	.25
Round Mountain	.38
Silver Pick	.10
White Caps	.14

COLO. SPRINGS* Mar. 31	
Cresson Con.	4.93⅛
Doctor Jack Pot	.04⅛
Elkton Con.	.05⅛
El Paso	.15
Gold Sovereign	‡.02
Golden Cycle	1.77
Granite	.14
Isabella	.05⅛
Mary McKinney	.06⅛
Portland	100
United Gold M.	.19⅛
Vindicator	.40

BOSTON EXCH.† Apr. 1	
Adventure	‡.75
Ahmeek	67⅛
Algomah	‡.30
Allouez	38
Ariz. Com.	11⅛
Arnold	‡.20
Bingham Mines	‡8⅛
Bonanza	‡.10
Butte-Balaklava	‡.22
Calumet & Ariz.	59
Calumet & Hecla	405
Centennial	‡12⅛
Copper Range	42
Daly West	2⅛
Davis-Daly	5
East Butte	8⅛
Franklin	‡3⅛
Granby	‡70
Hancock	5⅛
Hedley	‡12
Helvetia	‡.25
Indiana	.50
Isle Royale	25⅛
Keweenaw	‡.99
Lake	4
La Salle	‡2⅛
Mason Valley	‡2⅛
Mass	‡4
Mayflower	3⅞
Michigan	‡2⅛
Mohawk	55
New Arcadian	‡1⅛
New Cornelia	16
New Idria	‡9⅛
North Butte	10
North Lake	‡.50
Ojibway	‡1⅛
Old Dominion	34
Osceola	47
Quincy	53
St. Mary's M. L.	‡40
Santa Fe	‡.25
Seneca	‡13⅛
Shannon	2⅞
Shattuck-Ariz.	‡14⅛
So. Lake	‡1
So. Utah	.12
Superior	‡4⅛
Superior & Bost.	2
Trinity	‡2⅛
Tuolumne	.75
U. S. Smelting	50
U. S. Smelting, pf.	48⅛
Utah Apex	2⅛
Utah Con.	7⅛
Utah Metal	‡1⅛
Victoria	‡1⅛
Winona	‡.90
Wolverine	16⅛

N. Y. CURB† Apr. 1	
Big Ledge	⅞
Butte & N. Y.	‡.50
Butte Detroit	‡.05
Caledonia	.31
Calumet & Jerome	⅞
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	‡.13
Con. Ariz. Sm.	1⅛
Con. Coppermines	5
Goldfield Con.	.20
Goldfield Merger	.06⅛
Greenmonster	‡⅞
Hecla Min.	4⅛
Howe Sound	‡3⅛
Jerome Verde	⅛
Louisiana	.25
Magma	28
Marsh	.05⅛
McKinley-Dar-Sa.	.46
Milford	‡.75
Mother Lode	.45
Nixon Nevada	‡.40
Ohio Cop.	‡⅛
Rawley	‡2⅞
Ray Hercules	1⅞
Richmond	‡.56
Rochester Mines	.26
St. Joseph Lead	12⅛
Standard S. L.	⅜
Stewart	‡.15
Success	.05
Tonopah	‡3⅛
Tonopah Ex.	2⅛
Tribullion	‡⅛
Troy Arizona	‡.10
United Eastern	5
United Verde Ext.	‡32⅛
United Zinc	‡⅛
Utica Mines	‡.08

TORONTO* Apr. 1	
Adanac	.17
Bailey	.04
Beaver Con.	.43
Chambers Ferland	‡.10
Coniagas	2.00
Hargraves	.02
Kerr Lake	5.00
La Rose	.25
Lake Shore	.92
Min. Corp. of Can.	2.00
Nipissing	‡8.75
Peterson Lake	.07
Temiskaming	.30
Wettlaufer-Lor.	.04
Davidson	.68
Dome Exten.	.25
Dome Lake	.24
Mollinger	5.12⅛
McIntyre	1.62⅛
Newray	12⅛
Pocu. Crown	.26
Teck-Hughes	.26
Vipond	.20
West Dome	.13

* Bid prices. † Closing prices. ‡ Last quotations.